Your Bigger Self



UNITED YMCA SCHOOLS

THE UNITED Y.M.C.A. SCHOOLS

Extension Division

375 LEXINGTON AVENUE

NEW YORK, N.Y.

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THE WHITE HOUSE
WASHINGTON

January 10, 1922.

My dear Mr. Clarke:

With the liveliest recollection of the splendid work the Y.M.C.A. has performed in the public interest, I find it a real pleasure to give endorsement to your program for extending its educational activities.

It may well be doubted whether there are any instrumentalities of social service, better equipped than your own, to carry on the kind of work you are doing among the ex-service men.

Very sincerely,

Warren G. Harding

Mr. O.S. Clarke
c-o The United Y.M.C.A.Schools
Extension Division
375 Lexington Avenue
New York City.

A LETTER OF APPRECIATION FROM PRESIDENT HARDING

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THE UNITED Y.M.C.A. SCHOOLS
NEW YORK, N. Y.

THE · MOST · SERVICE · FOR · THE · LEAST · MONEY

Home-Study Courses

Taught by Correspondence

The Young Men's Christian Association, an organization with over thirty years' experience in educational work, now offers personalized correspondence instruction in more than two hundred and seventy-five courses.

UNITED YMCA SCHOOLS

THE UNITED Y.M.C.A. SCHOOLS

Extension Division

375 LEXINGTON AVENUE

NEW YORK, N.Y.



Headquarters of
The United Y.M.C.A. Schools
and the
International Committee of the Y.M.C.A.
347 Madison Avenue
New York



Headquarters of the
Extension Division
United Y.M.C.A. Schools
Instruction center of nearly 300 Correspondence Courses
375 Lexington Ave.
New York

Your Bigger Self

HUNT up one of the pictures that were taken of you when you were a youngster. Compare it with your latest photograph. How you have grown!

Then think a minute about the growth of your mental self. By the time a man reaches 20 to 25, he has stopped growing physically. Exercise and habits of eating and living will change weight and muscle but not the general size to any great degree.

Your mental self, however, does not have to stop growing when you get into the twenties. With proper attention, it keeps on growing—after you are twenty, thirty, forty, or older.

It is startling to hear the opinion of men who have given a great deal of study to mankind. They say that many thousands of men let their mental selves stop growing when they have reached only *a third or a half of their growth*—that the world is full of middle-aged people whose minds are no more developed than they were at the ages of 18 to 20.

On the front cover of this catalog is a picture of the two selves —the SELF that probably you are today and the BIGGER SELF that you can become—that you were intended to become.

A well developed body is a wonderful thing. Have as good a body as you can. Treasure it. But mere physique can't get you very far in real accomplishment. Your value is measured more by what is above your neck than by the section of your body below.

The man who wins is the man who *knows!*

To be a BIGGER MAN—to be fitted for more responsibility, to be ready for leadership, to be able to command congenial work, to be entitled to bigger pay, you must not content yourself with DREAMING of your Bigger Self. You must feed and exercise your mind just as you do your body.

Yes, you have TIME. Don't deceive yourself. All of us have time for what we really WANT to do. If you are like most men, you work from 48 to 54 hours a week. Sleep takes 56 hours more. You devote 18 to 21 hours a week to your meals. This leaves you about 40 hours a week. A third or fourth of this spare time devoted to the acquirement of useful knowledge will put you on the road to Success.

Watch your seven o'clocks. There is one every evening. On how you use your time from seven to ten depends your real stature among your fellowmen.



WATCH YOUR 7 O'CLOCKS

Board of Governors of the UNITED Y.M.C.A. SCHOOLS



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THE UNITED Y.M.C.A. SCHOOLS



WILLIAM F. HIRSCH, *Executive Secretary*

The Story of the Organization and the Men Behind it

FOR more than thirty years the Young Men's Christian Association has provided educational classes for young men. The Association was a pioneer in offering evening vocational instruction to men obliged to secure their training and education in spare time. It developed many of the courses and methods now widely used by other organizations and institutions. During all these years, first in evening schools and later in day schools also, the Association has sought to cultivate the highest and best kinds of personal relations between students and teachers, not only as a means of securing the largest educational result, but also because it believes that the development of right character is an essential part of a real education.

These ideals and aims commended themselves to thinking men and won the respect and confidence of students. As a result, the Association Schools grew steadily in number, size and influence.

In the spring of 1919, a great impetus was given to educational work in the Young Men's Christian Association by the organization of the United Y.M.C.A. Schools, which is a federation of nearly 400 local or resident Y.M.C.A. Schools, conducted in the principal cities of the United States and Canada, and which has as its aim the development of a continent-wide, standardized, Christian character-building program of education. By bringing all these separate schools into one great system, a very valuable interchange of experience and assistance has been made possible.

Y.M.C.A. Schools carry on class work in a wide variety of courses, ranging from the most elementary to those of collegiate grade. Twenty of these schools are authorized to grant collegiate degrees, having been approved by their State Departments of Education. During the school year of 1920-21, the schools included in the United Y.M.C.A. Schools organization enrolled in resident courses a total of 129,779 different students.

The United Y.M.C.A. Schools, both in the resident and in the extension or correspondence courses, are directed by a Board of Governors of fifteen men whose pictures are shown on the opposite page.

The chief executive officer of the United Y.M.C.A. Schools is William F. Hirsch, whose offices are at 347 Madison Avenue, New York City.

These men, as well as hundreds of others who are giving largely of their time and means to the work of the Young Men's Christian Association, are zealous and vigilant to see that the educational work of the United Y.M.C.A. Schools shall maintain the highest possible standards of service.

NAMES AND BUSINESS ADDRESSES OF THE BOARD OF GOVERNORS

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Educational Secretary West Side Y.M.C.A.
NEW YORK CITY

Thousands of Satisfied Students

The United Y.M.C.A. Schools have made no effort to secure endorsements from the hundreds of thousands of students under Y.M.C.A. direction during the past quarter of a century. If this work were undertaken, a veritable library of books could be filled. For in every section of America there are men in high positions who owe their advancement, to some extent at least, to courses offered by the Y.M.C.A. Hundreds of these men voluntarily write letters such as one from Edward W. Bok, a director of the Curtis Publishing Company, and many years editor of the "Ladies' Home Journal." Mr. Bok early in life enrolled for a course in the Brooklyn Y.M.C.A. His increased ability advanced him to a position as reporter for the "Brooklyn Eagle," and his climb thereafter was rapid. Mr. Bok says: "You can see what a big niche the Y.M.C.A. filled in the life of a poor boy; it gave him a chance to take advantage of the opportunities ahead of him."

Remarkable Results of an Investigation

In Cincinnati, several judges and many of the practicing attorneys are graduates of the law school operated by the local Y.M.C.A. In Dayton, Ohio, a very large proportion of the draftsmen, engineers, foremen, etc., owe their training to the Y.M.C.A. Like situations may be found in many cities.

Recently an investigation among students of the United Y.M.C.A. Schools studying by correspondence in a Middle Western state was made without the knowledge of the head office of these Schools. Remarkable as it may seem, 96½ per cent of the students expressed themselves as well satisfied with our educational service and the results attained.

It is unlikely that any other educational institution offering instruction through the mails could surpass this showing, even if they could equal it.

What Our Students Say About Y.M.C.A. Home-Study Courses

Courses Are Up To College Standard

"These Y.M.C.A. Home Study Courses are wonderful. The texts are the most practical and complete books I have ever seen. From what I have learned of engineering courses during my two years at College, I am convinced, as far as instruction goes, that these courses are up to college standard. No student can help feeling the influence of service which lies back of the whole Y.M.C.A. organization." ARLO R. LAUGEE,
26 Avery St., Laconia, N. H.

Course Brought Promotion

"Largely as a result of my spare-time study, for which I give the Y.M.C.A. their full measure of credit, I have been promoted to the position of bookkeeper in the office where I have been employed for some time. Without this preparation I would not have been able to hold the position, nor would the opportunity have been given me if my superior had not known of the effort I have been making to improve myself."
JOSEPH F. GREENLEE,
Charleston, W.Va.

Says "Y" Schools Are Different

"Correspondence Schools as a rule appreciate the tuitions more than a successful student, but you are different and I like you. I like your very interesting lessons, your methods of teaching Commercial Illustrating, and your frank criticism. Your course of instruction is unique, and as far as I have gone it has done me more good than I can tell you. Your textbook method of teaching is far better and different from the methods pursued by other schools. I have come in contact with several correspondence schools, but they cannot compare with your methods and lessons." HAROLD M. DORWORTH,
Franklin, Pennsylvania.

Dozens of Short-Cut Methods

"I find my course in Business Administration very comprehensive. It teaches me dozens of different short-cut methods, many of which are directly applicable in my daily work and would take me, if I were forced to get these methods single handed, many years of work in the business world. With this comes a very solicitous feeling on the part of the instructors. Even the Secretary himself appears personally interested in my welfare." EDWARD S. RIDER,
1315 Pacific Ave., Atlantic City, N. J.

Easy to Understand—Readily Applied

"I wish to express my appreciation of the way you have helped and advised me while studying your course in Poultry Husbandry. I have never asked for help or advice in any way that has not been given with the greatest care. The course itself is thorough in every respect. It is easy to understand and can be readily applied. I do not hesitate to recommend this course to my friends or anyone else."
VENUS B. WEATHERFORD.
Roberts, Ill.

Recommends Advertising Course

"I have been taking the Y.M.C.A. Advertising Course and desire to express my pleasure and satisfaction with the manner in which it is given. There is just enough theory to give one an excellent idea of various methods involved in the operation of Advertising work. The instructors, one of whom I personally know, are able and experienced and are only too willing and pleased to be of any aid. I have had several experiences which have impressed me of this fact. I heartily recommend this course to any person who desires to study advertising." JOHN E. WEITZEL,
Elizabeth, N. J.

Course Is Not All Theory

"I am enjoying my course in Farm Management very much. I especially like it because it is not all theory and can be applied every day on the farm."
ROY H. ELLIOTT,
Fayettesville, Arkansas.

Installs Bookkeeping System

"The manager of a little rubber-heel company came to my boss at the Overland one day in January and told him that he had decided to install a new bookkeeping system and would like to have a young man to fill the job. My boss knew that I was at the time taking a course in this work and asked me if I was well enough along to tackle the job. I told him yes. With the help of the course I have started with you I have completed the costs and statements for the first two months. The Board of Directors said the reports were fine and congratulated me on my work." DON E. PHELPS,
Elyria, Ohio.

Finds Course Complete in Every Detail

The writer cannot refrain from offering a few words of commendation in favor of the excellent course in Storage Batteries offered by the Y.M.C.A. Schools. I have found my course complete in every detail and administered with a thoroughness that has been very gratifying. I wish you unbounded success. C. V. GILMORE,
2931 Atlantic Ave., Atlantic City, N. J.

Salesmanship Course Applies to Any Walk in Life

"I have received so many benefits from my course in Salesmanship that I hardly know which is the greatest. It has taught me to concentrate and study, it has set my brain to working, taught me to think as never before. It has improved my character, and put me on the road to success in many things I have undertaken. I find the principles of this course work in any walk in life, not alone in salesmanship. So the greatest thing I have received from this course is the right road to success and happiness." H. J. REED,
13 Hauber Ave., St. Marys, Pa.

Executive Staff, Extension Division
UNITED Y.M.C.A. SCHOOLS



FRED R. STARKEY
Supervisor of Student Service



EDWARD C. BALDWIN
Business Manager



JOHN G. THORN
Registrar



H. S. GORHAM
Cashier



J. FOSTER HILL
Director



R. O. BABCOCK
Accountant



E. L. GERE
Supervisor of Instruction



CLINTON S. MARSH
Asst. Supervisor of Instruction



W. R. PARNELL
Mail Sales



G. N. ACKERMAN
Sales Manager



R. EARLE WILLIAMSON
Advertising



JOHN G. OLMSTEAD
Association Sales

THE EXTENSION DIVISION

UNITED YMCA SCHOOLS

Superior Home-Study Courses

Especially Prepared for Effective Instruction
By the Correspondence Method

FOR the purpose of offering correspondence instruction under the same general principles and with the high aims that characterize the Y.M.C.A. resident school work, the United Y.M.C.A. Schools, in the fall of 1919, organized the Extension Division. Prior to this time Y.M.C.A. educational service was confined to some 400 of the larger cities and towns. This enlargement of the scope of the work meant that the organization became able to offer its high-grade instruction and service to any person anywhere. A special reason for extending the service was the need of providing correspondence courses for ex-service men who were receiving scholarship assistance from the War Work Council of the Y.M.C.A. Furthermore, the large general interest in correspondence instruction had created a demand for such instruction at reasonable rates with a guarantee of adequate service and helpfulness to students. To this high purpose the Extension Division was dedicated.

On November 1, 1919, Mr. J. Foster Hill, a graduate of Harvard University, who has had twenty-five years of experience as an educator, both in the Y.M.C.A. and in the correspondence school field, was commissioned to undertake the task of preparing the courses of study and of engineering the school. He gathered quickly a large staff of trained specialists and with their untiring assistance and whole-hearted co-operation there were prepared some fifty courses with which to begin the work for ex-service men. The first student was enrolled February 20, 1920, and the school grew rapidly from that day. During the first two years 26,008 students were enrolled, representing every state in the Union and nearly every Province of Canada, as well as several European and Asiatic countries.

In the two and one-half years that the Extension Division has been in operation more than two hundred and seventy-five courses of study have been prepared, covering elementary, high school, vocational, scientific, agricultural, engineering, language, and commercial subjects. In fact, practically every subject that may be studied by correspondence will be found listed and described in this general catalog.

The schools are operated for service, not for money profits. All that the student pays can therefore be used in the maintenance of service. The aim is solely that of helpfulness to the student. Hence, the slogan, "The most service for the least money."

All courses are based on the newest and best standard textbooks. We are thus able always to keep our courses up-to-date and can take advantage of the best productions of the most skillful and practical writers. These texts are supplemented by instruction sheets and personal correspondence with the teacher—a combination that makes the United Y.M.C.A. Schools correspondence teaching plan strikingly effective.

The Y.M.C.A. Schools have always sought to develop sympathetic personal relations between student and teacher. That the Extension Division has succeeded in a remarkable way in personalizing its instruction-by-mail methods is shown by hundreds of letters from students who feel as the one who wrote: "I don't see how, with your thousands of students, you succeed in making me feel that I am getting the undivided attention of my teacher."

In giving the United Y.M.C.A. Schools instruction-by-mail service there are employed a carefully selected and adequately trained staff and faculty. The executives are men of wide experience in their various specialties, while practically all the men and women on the faculty have college training and successful teaching experience, as well as high personal character.

The Extension Division, in the ability and experience of its executives and instructors, is a tried and efficient organization. The Y.M.C.A. in undertaking this new educational work is able to draw on a more far-reaching experience in spare-hour teaching than perhaps any other educational institution. Many subjects were taught in Y.M.C.A. classes before like instruction was available in other schools. The increasing field organization of the Extension Division and its affiliation with nearly 400 resident Y.M.C.A. schools, all part of a continent-wide system of education, give to students opportunities of personal service and helpfulness not to be had elsewhere in the field of correspondence instruction.

Advantages of Correspondence Instruction

Thirty years ago, when the correspondence method of giving instruction was first suggested in the United States, few people interested in educational work believed that satisfactory instruction could be given through the mails. The method was regarded as a fad or novelty. The critics did not reflect apparently that the United States Government, the newspapers and magazines and other agencies were distributing a vast amount of useful information by the correspondence method. They forgot that even the Greatest of Books consisted largely of letters from the apostles. They overlooked the hundreds of thousands of ambitious people whose duties keep them from attending classes.

Today at least fifty colleges, universities, and other public educational institutions are operating correspondence or home-study divisions. In addition to these there are at least two hundred private correspondence schools offering instruction in almost every conceivable subject. The correspondence school has long ago passed the experimental stage. The question today for the person needing such a school is "which one will give me the best type of service?"

The Young Men's Christian Association undertook its first correspondence teaching in France in 1918 for the purpose of providing courses of study for American soldiers whose military duties prevented them from entering the resident schools established in various parts of France. When the need for such a school no longer existed in Europe, the Extension Division of the United Y.M.C.A. Schools was formed in New York as a supplement to the resident educational work which is conducted by several hundred local Associations in the United States and Canada. This new department fills a real need. It brings to men and women everywhere a great variety of courses at a low cost for the most personal type of service.

Scope of the United Y.M.C.A. Schools Courses
And Methods of Correspondence Instruction

A PERUSAL of this catalog will convince the reader that the Extension Division of the United Y.M.C.A. Schools now has the most complete and practical list of correspondence instruction ever offered. Some of the advantages of correspondence instruction as offered by this school are summarized in the following fourteen points of Y.M.C.A. service.

1. The method of studying a Y.M.C.A. course by mail enables men and women everywhere to utilize even short periods of spare time in following systematic and profitable courses of study—not only the spare hours at home, but odd minutes on the car or at noontime.

2. The basis of all good teaching is self-expression on the part of the student. The students of the extension division recite their entire courses in writing, which is the most thorough of all recitation methods. "Reading maketh a full man," declared Lord Bacon, "and writing an exact man."



Students' Textbooks and Supplies Are Mailed Immediately

3. Our correspondence method of instruction enables the student to crystallize his ideas in his own mind while preparing his written work. The knowledge gained becomes a permanent part of his mental equipment, readily accessible whenever needed.

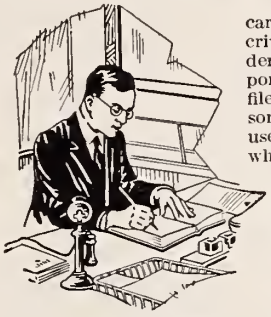
All criticism of the student's written recitations is individual. The instructors have before them the educational records of the student which show progress made with the course to date and the success which the student has had with each lesson. The instructor moreover has additional information such as the student's age, occupational experience, and extent of his previous education, which enables him to deal intelligently with the student.



Instructor Assisting Student to Grasp Difficult Problem

4. The work of the teacher is carefully inspected. This reduces or eliminates errors of oversight or of mere personal opinion on some mooted point.

5. The written work sent by the student is returned so that he may review carefully the written criticism. Each student is provided a portfolio in which to file all returned lessons so that he may use them for review when preparing his advanced lessons. Our students may read the instructor's explanations over and over again. No word of explanation or solution of a difficult problem is lost.

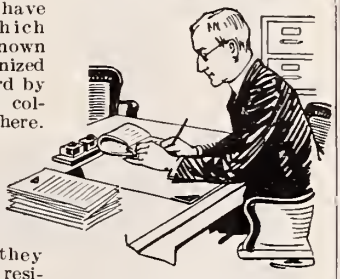


Registrar Enrolling Student by Mail

6. All students are supplied with memorandum blanks and are urged to write frequently for explanations of things they do not thoroughly understand. Hundreds of letters are sent every day to students who need additional instruction about particular points in the solution of some difficult problem or project.

7. Every student is himself the class and may proceed as rapidly as time and ability will permit, or as slowly as may be necessary.

8. The newest and the best standard textbooks are used. It is a great advantage to students to have textbooks which are well known and recognized to be standard by schools and colleges everywhere.



Experienced Instructors Correct Lessons Carefully

9. Then, too, the textbooks serve only such purposes as they would in a resident school. Special texts and instruction sheets designed as substitutes for lectures and class-room instruction are important features of the courses. The vital portions of each lesson are pointed out and the difficult parts are explained in detail. Questions and problems on each lesson take the place of the class-room recitation or written quiz. The instructor corrects the student's work, indicates all errors, and, if necessary, explains more completely or sometimes requests the student to send in additional

work. Instruction is in every case suited to individual needs and progress of the student, and special information relating to his work is supplied without limit.

10. Our courses include only the theory that is accepted as necessary by resident schools of standing. In addition we introduce every student to the practical phases of the subject in a way that is seldom undertaken elsewhere.



Department Heads Take Personal Interest in Student's Work

The supplementary helps that accompany every lesson are unexcelled for clearness and helpfulness. We have kept in mind that the student who is studying alone needs every aid. Rarely does he find himself unable to proceed intelligently with a new lesson. Step by step he acquires information of the most usable kind and finds himself growing enthusiastic over his increasing mental powers. Each lesson leads him on to the next with a continuity of interest and progress which is sustained throughout his entire course.

11. In New York City, where most of the courses have been written or arranged, we have had the assistance of specialists in every field. Probably in no other city would it have been so easy to secure this broad cooperation. Here are great universities and libraries and the greatest publishing houses. Text-writers, editors, practitioners, teachers, have in almost every case seemed very glad to be able to play a part in Y. M. C. A. educational work. It appeals to them as a high form of service in which they are proud to assist, and this attitude in approaching their work has called forth their most earnest efforts. They have given freely and whole-heartedly of their time and talents to further the welfare of the great army of men and women enrolled in Y. M. C. A. home study courses.



Students Benefit by Prompt Return of Corrected Lessons

12. When the student desires to omit any of his work it is necessary for us to know what educational training or schooling he has had; his practical experience, particularly the kind of work he has done in the last six years or so (this means the nature of the work, not the names of his employers), and his present occupation. While it is not imperative to send this information with the application, often it may save time and enable him to begin his studies without delay.



The Student's Grade for Each Lesson is Carefully Recorded

13. The Extension Division of the United Y. M. C. A. Schools operates on the platform of service and assumes full responsibility for seeing every student through. It does not satisfy our organization to enroll the student for a course and collect his money. We know that if the responsibility is left with him, often he will not go far with his course. We are anxious to have all our students complete their chosen courses, receive their certificates or diplomas, and make practical application of what they have learned.

We therefore follow up our students for years, if necessary, making every possible effort to keep up their interest. A strong department for this purpose was established when the school was organized. It is glad to have a student write confidentially about any personal problem which may interfere with his studies or affect his success in life.



Student's Progress is Aided by Sincere Personal Interest

14. We are always very ready to assist the student in making a decision regarding his future employment and we do everything possible to assist him in securing a position where he can apply the principles he is studying in his course. We take pride in recommending our deserving students to prospective employers, and we help these students by advice and encouragement over the more or less difficult period of adjustment to a new position. Our students know we are watching their progress with interest, and this does much to spur them on toward success. When we enroll a student, we stand ready to be his friend as well as his school. Our motto, "The Most Service for the Least Money" is more than an apt slogan with us. It is a live expression of our purpose—one that is always before us.

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*Optional.—*We reserve the right, at any time before the student completes his course, to require the work on optional subjects if, in our judgment, the student needs this training.*

What He Did You Can Do



"I HAVE purchased a business and by the use of methods explained in my United Y.M.C.A. Schools Course have increased my business 75% in two months."

This is an extract from a letter received a short time ago from a young man in New Jersey. In all parts of the country, former students are enjoying similar successes and rapid advancement by applying the knowledge they received under our instruction to the business of making a living.

Think Ahead of Your Job

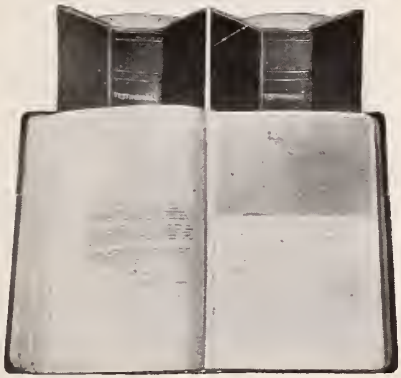
If you expect to win in the race for a bigger job you must know more than the other fellow knows. Study your job so you can do your work better than any one else. But don't stop there. Pick the bigger job you would like to have; then work for it. We can help you prepare yourself to handle its duties and responsibilities. When you know and your employer finds out that you know, your advancement will be rapid.

Knowledge Draws the Better Salary

Long hours, monotonous work and low wages are the penalties for not knowing how to do one special line of work better than the other fellow. There are always plenty of low paid subordinates looking for jobs. But when it comes to filling a position that requires a special training, it is difficult to find the right man, no matter how large the salary offered. You can get into this much-sought-for-class of trained workers by making your spare hours count for something. With our capable, personalized instruction you can turn these spare hours into dollar-hours. Large profits will reward you for the time invested. Others have done it, so can you.

Three Large Volumes Full of Testimonials Like These

Students in all parts of the country are enthusiastic in their praise, not only of the high-grade instruction received but also for the close personal interest taken in the individual student's welfare. Thousands of voluntary letters of appreciation come to us daily. Extracts from these letters show that our best advertisers are the students themselves.



What They Did You Can Do

$75.00 Investment Brings in $225.65

I thank you for your attention in regard to my lessons. The course in Automobile Construction and Repair has already helped me very much. I am kept so busy that I can hardly take enough time to get my lessons properly. Since starting this course I have taken in $225.65 and I have four cars waiting for me to work on, besides five cars, at another place, so you see I have all I can do. All this work is extra for I work at night for the American Railway Express Co.

HARRY S. MASON,
Ottumwa, Ia.

Home Study Brings Fifty Dollar Increase

Shortly after starting the course I was interviewed with reference to a better position. One question asked me was, "Are you doing any Home Study?" And, believe me I sure told that I was. Now I am breaking into harness. My salary has increased from $200.00 to $250.00 per month, so I sure feel justified in digging in after more.

A. W. FELTS,
Santa Maria, Cal.

Since Beginning Course Salary is Tripled

When I started the course I had never sold anything, but always had a desire to be a salesman. Through what I learned from your course I have been able to secure a position as salesman with three times the salary I was drawing when I started to study.

A. V. SIGARS,
Joplin, Mo.

Becomes Advertising Manager

It may interest you to know that I have received a position as Advertising Manager for the Bender and Brett Stores. I have undertaken this job on the strength of what I have learned under your instruction.

J. MURRAY SHOLLER,
Altoona, Pa.

Study Reaps Large Profits

Made a profit of $532 on my hens after studying your course in Poultry Husbandry.

JAMES F. JONES,
Federal, Ky.

All Expectations Surpassed

Your course surpassed all my expectations and the personal touches of encouragement are a great incentive to study harder.

GEO. F. HARRITY,
Woodsville, N. H.

Five Lessons and He Sells a Picture

After five lessons in your Commercial Art course, I sold my first picture for ten dollars.

JOHN DRAYCOTT,
Pawtucket, R. I.

From Packer to Shipping Clerk

When I enrolled for this course I was packer. Since then I have been promoted to shipping clerk. 'Nough said.

C. O. ZEIMER,
New York City.

Practising Dentist Profits by Study of Salesmanship

I have been a practising dentist for several years with varying success. Since taking your course in salesmanship I have increased my business 30% and in face of competition have been enabled to raise my prices 50%. Again I want to tell you what a great help your instruction has been to my success. (*Name Upon Request*).

Becomes Publicity Man

You will no doubt be glad to know that I have been promoted, thanks to the help given in your advertising course. I have been given a position in the Publicity Department of the General Offices of the Bell Telephone Co., Omaha.

ARMIN E. KOEHLER,
North Minneapolis, Minn.

Course a Big Help in Everyday Business

Your course has been a great help to me in my everyday business. The knowledge gained from the study of your course has saved for me the loss of hundreds of dollars.

ELIAS K. KHALOUF,
Indiana, Pa.

Study Courses Carry Four Men to Larger Success

Four of our men studied the standard United Y.M.C.A. Schools course in Salesmanship. One is now a Sales Manager, another a New York city salesman, the third covers New York and Pennsylvania and the fourth is eastern manager for a large company. Not one was in the selling game before taking up your course in salesmanship.

H. J. SWANN, Manager of Sales,
Turtle Brothers, New York City.

Whole-Hearted Interest Certainly Helps

I have never in all my life experienced anything in which so much whole-hearted interest has been displayed as by your people in teaching this course.

BRUCE WRAY,
Eagle Pass, Texas.

100% Rooter for "Y" Courses

Allow me to thank you for the benefits received from your Traffic Management course. I have installed a traffic management system in the firm by whom I am employed, thereby saving them hundreds of dollars. By showing these results I am pleased to say that my salary has been increased $25 a month. You will always find me a 100% rooter for the "Y" Courses.

W. A. REID,
West 35th St., New York City.

Recommends School to All Who Wish to Succeed

I feel very lucky to be enrolled in the Y.M.C.A. Schools. I have studied several other correspondence courses but found none to come up to the "Y." I can honestly recommend your school to all who have an ambition to succeed.

L. W. FOLAND,
Schenectady, N. Y.



WHEN Business calls upon an employee to do a piece of work, that man must be ready and able to do it or Business passes him by for the man who can. Business is growing too rapidly these days to take the time to teach its employees by the old slow method of experience.

The young man who wants to get into business, or the ambitious man already in business, who wants to rise to higher positions, must prepare himself in spare hours. Business will not wait. He must be ready when opportunity comes.

Opportunities in business are numberless. The wide range of commercial pursuits, the variety of positions within a business, and the many duties of each position, call for all temperaments and types. There is a place for almost every man, if well trained; even the most minor positions require training.

Practically every large business executive in this country of opportunity rose to his present position of importance by training to do the job at hand better than the other fellow. Men who control millions of dollars and direct the destinies of huge corporations; men who have risen to the highest positions in the land, are vivid examples of the responsibilities open to every man. Chas. M. Schwab in less than a quarter of a century rose to the presidency of one of America's largest steel companies. He is but one of the thousands of men who by diligent industry and spare-time study have risen to the top.

In order to operate successfully a one-man retail store a man must be trained in modern business methods, or he is likely to join the great army of bankrupts reported yearly by Dun and Bradstreet. To operate a big business he must be doubly prepared. The larger the business the more specialized are the positions, leaving less opportunity during working hours for one employee to learn the work of another. If he would know the job alongside him, or the one just ahead, he must pursue a course of study aside from working hours.

Teachers of Experience to Guide Your Progress

W. W. Harries, B.A., C.P.A.—Graduate of the University of London, England; Certified Public Accountant of New York; with actual experience in business, and as practising accountant and auditor; business letter specialist; formerly manager, principal, and owner of business colleges in the United States, Canada, and England. As head of the Department, Mr. Harries takes a personal interest in every student, supervises his staff of instructors, and inspects all work sent in by students.

W. C. Price, A.B.—Graduate of Lafayette College; graduate work in School of Business Administration, New York University; formerly teacher of commercial subjects in high schools. Mr. Price is chief instructor in Business Law, Banking, and Finance.

C. M. MacDow—Graduate of Boston Institute of Business Administration; has taken special work at New York University; also at Boston, specializing in accounting courses; formerly secretary and instructor in accounting at Boston Institute of Business Administration. Mr. MacDow is head of the Accounting and Auditing section.

These assisted by a large staff of qualified and experienced Instructors, give personal attention to all work sent by the students, supplementing their corrections with personal letters.



W. W. HARRIES

Accountancy

(Co-19x)

There are over 300,000 business corporations in the United States. Each of these concerns must have at least one man expert in the knowledge of accounting, while a great number of the larger corporations employ as many as one hundred high salaried accountants. Then there are accountants operating independently and serving a number of clients. The demand for men conversant with accounting so far exceeds the supply that Accountancy ranks as one of the highest paid professions.

Due to the fact that there are comparatively few men expert in the knowledge of this profession, the man who adds to his knowledge of bookkeeping a training in accounting is able to reach an enviable position among business men because he is trusted with the inmost secrets of their business affairs.

This course covers every phase of accounting in a thorough, result-getting manner. It prepares the student to perform efficiently the duties of accountant and auditor; also prepares for the C.P.A. examination in any state.

Subjects Covered in This Course:

ACCOUNTING (Co-2)—**Fundamentals of Accounting**—History and development of accounting. Proprietorship. Types of business organization. Financial statement. Profit and loss elements. Profit and loss summary. Debit and credit. Types of journals. Business papers. Business methods. Posting. The trial balance. Closing the books. Classification of accounts.

Partnership—Business viewpoint. Accounting viewpoint. Cash. Discounts. Notes receivable and payable. Sales. Capitalization. Partnership problems. Partnership profits. Dissolution. Accounting records. Controlling accounts.

Corporation—Formation. Opening and closing corporation books. Consignments. Approval sales. Debenture accounts. Accounts current. Installment sales. Proportion. Balancing methods. Single or simple entry. Some phases of interest.

Problems of Valuation—Corporation classes of stock. Accounting for stocks. Voucher system. Factory costs. Balance sheets. General principles of valuation.

Problems of Depreciation.—Aspects of depreciation. Definitions. Causes. Factors of rate determination. Methods of calculating. Appraisement of various methods. Recording depreciation on the books.

Problems of Liquidation—Cash and mercantile credits. Merchandise stock-in-trade. Temporary investments. Accrued and deferred items. Permanent investments. Machinery and tools. Furniture and fixtures. Other equipment. Building, land, and wasting assets. Patent. Franchise. Good-will. Liabilities on balance sheet. Bond and mortgages. Capital stock and its valuation. Surplus and reserves. Sinking fund. Dividends. Liquidation of a corporation.

Profit and Loss—Problems. Summary. Standardization of form. Content and manner of showing.

General Problems—Reason for combination. Types of consolidation. Branch house accounting. Suspense accounts. Numbered accounts. Statistics in business. Private books. Journal vouchers. Consolidated balance sheet and profit and loss summary. Accounts and reports of receivers and trustees.

Application of Accounting Principles—Organization for accounting control. Analysis of borrower's financial statements. Foreign exchange. Savings banks. Coal mining. Precious metal mining. Farms. Malleable iron industries. Contractors. Coffee trade. Department stores. Public accountants office. Advertising agencies. Hotels. Municipalities.

COMMERCIAL LAW (Co-31)—Definition of contract. Essentials of enforceable contract. Classes of agreements. Competent parties. Operation and discharge of contracts. Contracts concerning sale of goods. Bailment of goods. Insurance contracts. Contracts concerning credits. Negotiable instruments. Conduct of business through representatives. Partnerships. Joint stock companies. Corporations. Property in land and movables. Personal property.

INCOME TAX PROCEDURE (Co-30)—Periodical income. Gains and profits. Income deductions. Depreciation and depletion. Net income for corporation. Domestic and foreign corporation. Exempt corporations. Types of tax. Invested capital. Returns. Payments and claims. Inspection of returns. Information at source. Matters partially obsolete. Capital stock tax. Functions of tax practitioners. Handling doubtful matters.

COST ACCOUNTING (Co-4)—Principles. Cost accounting in modern business. Routine. Methods. Relation between general ledger and cost accounting. Indirect expense accounts. Stores and stores department. Stores accounting and records. Stores problems. Recording cost of labor. Time and pay records. Indirect expense. Schedule of fixed charges. Expense distribution. Representative cost systems. Graphic presentation of cost data. Use of charts. Forms.

BUSINESS ECONOMICS (Co-5)—Underlying conditions of national prosperity. Primary factors of production, labor, power, land, capital. Productive industries. Relation of utility to value. Banking. Marketing. Free trade. Protectionism. Distribution of wealth. Wages. Labor organization. Rent of land. Source of interest. Cost of capital. Profits. Consumption of wealth. Rational consumption. Luxury. Taxation. Financing of war. Communism. Socialism. Anarchism. Constructive Liberalism.

AUDITING (Co-6)—Purposes and advantages of audit. How to begin an audit. Balance sheet audit. Current assets. Cash. Accounts receivable. Inventories. Fixed assets. Wasting assets. Contingent assets. Secret reserves. Liabilities. Reserves. Partnerships. Capital and surplus. Profit and loss account. Certificates and reports. Detailed audit. Completed audit. Continuous audit. Verification of income. Trial balance. Depreciation. Investigations. Holding companies. Interest.

Cost Accounting

(Co-9x)

No single subject is of more interest to business executives today than that of scientific cost accounting. An applicant can offer no better reason for his employment in an executive or production department than the statement "I understand cost accounting well."

Everywhere manufacturers and merchants are discussing methods of figuring costs, devising uniform cost systems and seeking the best way of ascertaining their manufacturing and selling expense. This lucrative field is open to the man who can devise, install, and put in operation a practical cost system; and this is what the Extension Division, United Y.M.C.A. Schools trains men to do.

Topics Covered in This Course:

COST ACCOUNTING (Co-4)—General Principles—Cost accounting in modern business. Importance of cost accounting. Function of cost accounting. Elements of production cost. Cost determination.

Cost Accounting Procedure—Routine of cost accounting. Cost sheets. Cost accounting methods. Simple products. Process costs. Order method of production. Order cost accounting. Estimated costs. Estimating cost systems.

Relation Between General Ledger and Cost Accounts—Financial and cost accounts. Entries to general ledger controlling accounts. Order method. Process method. Indirect expense accounts. Closing the controlling cost accounts.

Material Costs—Stores and stores department. Stores accounting and records. Stores problems. Classification.

Labor Costs—Recording cost of labor. Time and pay records. Wage systems.

Indirect Expense—General consideration. Indirect labor and supplies. Fixed charges. Depreciation. Expense distribution. Machine hour rates.

Representative Systems—Productive center job. Order cost system. Process cost system. Estimated costs. Textile costs.

Graphic Representation of Cost Data—Statements. Difference charts. Ratio charts: Illustrations. Limitations and difference charts.

Income Tax Procedure

(Co-42x)

Every business house and millions of men and women must pay a yearly toll to the government. Federal and state legislatures have passed tax laws that are difficult for the average man to interpret, hence many people must turn to the expert in this field for assistance.

Trained tax experts are in constant demand throughout the country, and they receive comfortable salaries for their services. This course will give you the latest and most authoritative information on income tax procedure, based on the Federal Revenue Act of 1921. Men with a fundamental knowledge of bookkeeping and business can become proficient in tax procedure in a short time.

Topics Covered in This Course:

INCOME TAX PROCEDURE (Co-30)—Income—Taxes. Effect of law. Periodical income. Net income. Gross income. Compensation. Interest. Dividends. Gains and profits. Sales. Exchanges. Income deductions. Depletion. Depreciation. Net income of corporations. Net income of persons. Exempt corporations. Accumulated profits. Foreign governments. States.

Tax—Individual normal tax. Credits and exemptions. Surtax. Corporation income tax. Excess profits tax. Special cases. Invested capital. Stock paid in. Surplus and undivided profits. Consolidations and affiliations. Individual returns. Fiduciaries. Corporation returns. Partnership returns. Filing. Payments. Claims. Formal procedure. War profits tax. Inventory losses. Rebate losses. Capital stock tax.

Practical Discussion—Functions of tax practitioners. Handling doubtful matters. Analysis of returns. Accounting for tax purposes.

NOTE—As the law is amended the student will be posted on all changes.

Finds the Cooperation of Y.M.C.A. Instructors a Real Help

As a student of the United Y.M.C.A. Schools, I wish to say that the Correspondence Instruction that I have received from your course has helped me more than any of the three other correspondence courses I have taken. The system expressed every detail necessary, also when any additional information is required, your service is very efficient.

I feel justified in recommending any of the courses, as I am sure, if the instructions are followed carefully, other students will benefit from your courses as I have.

—CHARLES A. WATKINS, 28 Temple Street, Nashua, N. H.

"I Will Study and Get Ready and Maybe My Chance Will Come."—Lincoln

Auditing

(Co-20x)

The auditor is a specialist. He occupies a dignified, responsible and well paid position, one to which the bookkeeper or the accountant may aspire.

The United Y.M.C.A. Schools offer in this course practical instruction in auditing theory and practice. It deals thoroughly with the responsibilities, duties, and procedure of the auditor.

The textbook used is the standard American work on the subject, and the course is modern in every way.

Topics Covered in This Course:

AUDITING (Co-6)—Purposes and Advantages of an Audit—Detection of fraud. Detection of errors. Conditions of affairs. Procedure followed in an audit.

Balance Sheet Audit—Current assets. Cash. Accounts receivable. Notes receivable. Inventories. Fixed assets. Wasting assets. Contingent assets. Liabilities. Contingent liabilities. Partnerships. Capital and surplus.

Profit and Loss Account—Definitions of profits. Gross earnings. Net earnings. Profit on sales of assets. Expenses and losses. Depreciation. Discounts. Disposition of profit. Principal and income.

Certificates and Reports—Scope of report. Form of balance sheet. Standard form of borrower's statement. Statement of financial condition. Profit and loss statement.

Detailed Audit—General principles. Audit of income and expenses. Verification of income. Purchases and expenses. Trial balance. Asset and liability items. Office methods.

Investigations—Scope of work. On sale or purchase of a business. Analysis of earnings and expenses. System of accounts. Elimination of unusual terms. Investigation for creditors, etc.

Holding Companies—Form of balance sheet. Accounts receivable. Profit and loss account. Comparative statements.

Interest—Principle. Rate of interest. Custom among stock brokers; business houses. Custom in banks and trust companies. Treasury department of United States. Unit period.

Complete Commercial

(Co-1x)

In a great many small business offices there is need for young men with a well-rounded commercial education—the ability to keep books, to perform the duties of stenographer, or to fill the responsible position of private secretary. Such positions bring to a young man a broader knowledge of the business as a whole than that gained by one who is merely a bookkeeper, a stenographer or a clerk.

The applicant who possesses the various qualifications has more opportunities open to him and can make a better selection. Furthermore, if his aim eventually is to go into business for himself, he needs the comprehensive training afforded by a practical general commercial course. Such a course includes all the fundamentals of a good business education. It gives a young man the equipment he needs whether he enters the employ of the manufacturer, wholesaler, retailer, or some special field such as finance, real estate or insurance.

The United "Y" Complete Commercial Course is a combination of Business Arithmetic, Bookkeeping and the Secretarial Courses, plus the final training in Business English and Correspondence. The ambitious young man, attracted by the business field, will do well to select this course.

Subjects Covered in This Course:

BOOKKEEPING (Co-10)—Single entry. Double entry. Types of accounts. Posting books of original entry. Closing the ledger. Outline of accounts used in partnership. Accruals and deferred items. Manner of corporation organization. Types of accounts. Exhibits and schedules. Corporation bookkeeping and accounting. Advantages of cost system. Important features of cost system. Trial balance. Books of account. Interest. Consignments.

BUSINESS ARITHMETIC (Co-11)—Fundamental operations. Percentage, interest, banking, dividends and investments, as employed in business organizations large and small.

PENMANSHIP (Co-12)—Muscular movement writing for business or social use. The essential training for developing character in handwriting.

TYPEWRITING (Co-13)—Mastery of the keyboards. Typewriting technique. Accuracy drills. Speed drills. Business correspond-

ence. Tabulating and billing. Legal manuscripts. Business papers.

BUSINESS ENGLISH AND CORRESPONDENCE (Co-15)—Parts of speech. Word study. Common errors. Modifications of parts of speech. Analysis and classification of sentences. Punctuation. Capitalization. Correspondence. Composition of business letter. How to construct effective sentences. Brevity and clearness. Completeness. Letter of application. Letters of inquiry. Collection letters. Form letters. Telegrams and cablegrams.

When the character of the student's work to this point justifies a more advanced subject, Business English and Correspondence (Co-9) will be substituted for Business English and Correspondence (Co-15).

***GREGG SHORTHAND** (Co-14)—A light-line system. No shading. No dots, dashes or position writing. Practice in accuracy. Practice in speed.

***ISAAC PITMAN SHORTHAND** (Co-19)—The original system of phonography. Practice in speed. Practice in accuracy. Building up a complete vocabulary.

***GRAHAM SHORTHAND** (Co-18)—Building up a complete working knowledge of the system. Practice in accuracy. Practice in speed.

BUSINESS LAW (Co-1)—Formation of contracts. Competent parties. Operation and discharge of contracts. Discharge in bankruptcy. Contracts concerning goods. Sales of goods. Duties of seller. Duties of buyer. Bailment of goods. Contracts concerning credits. Negotiable instruments. Conduct of business through representatives. Property in land and movables. Real property. Personal property.

**Only one of these subjects will be supplied. Unless the student specifies otherwise, Gregg Shorthand will be sent.*

Bookkeeping and Business

(Co-18x)

The close affiliation of business concerns over the country has brought about considerable standardization of business methods. The time when a man must start as an office boy and work up through every job is fading into the past. Today all modern business methods can be taught clearly and thoroughly—so thoroughly that when a course such as this Bookkeeping and Business Course has been completed, the student is capable of handling successfully almost any business office work that may arise.

The demand for men with a good general knowledge of business methods is far greater than the inadequate supply; men with a good business training are only too few. The calls for the man educated in the fundamentals of business are unlimited; he is wanted by the retailer, the jobber, the manufacturer. He commands a salary of $2,500 or more, according to his experience and ability.

This course teaches bookkeeping and takes the student into the field of business practice, explaining the methods followed by the modern business concerns and leading accountants so thoroughly that he will acquire an accurate practical knowledge of business and its fundamental laws.

Subjects Covered in This Course:

BOOKKEEPING (Co-16)—Single entry. Double entry. Types of accounts. Posting. Recording in journal. Types of journals. Outline of accounts used in partnership. Accruals and deferred items. Manner of corporation organization. Exhibits and schedules. Corporation bookkeeping and accounting. Advantages of cost system. Important features of cost systems. Books of account.

BUSINESS ARITHMETIC (Co-11)—Fundamental operations. Percentage, interest, banking, dividends and investments as employed in business organizations large and small.

PENMANSHIP (Co-12)—Muscular movement writing for business or social use. The essential training for developing character in hand writing.

BUSINESS LAW (Co-1)—Principles of contracts. Competent parties. Operation and discharge of contracts. Contracts concerning goods. Sales of goods. Duties of seller. Duties of buyer. Bailment of goods. Insurance contracts. Contracts concerning credits. Negotiable instruments. Form. Conduct of business through representatives. Principle and agent. Master and servant. Partnerships. Joint stock companies. Definition and classification of corporations. Real property. Personal property.

Printer-Editor from Grove City, Pa., Endorses Bookkeeping and Business Course

I have been compelled to change my father's book system from the single to the double entry, a feat that would be well nigh impossible even with the help of a good stenographer were it not for my "Y" course. Thanking you for your unselfish interest in me and promising to send along my first lesson soon, I beg to remain.

Gratefully yours,

(Signed) J. B. ROBINSON, Jr.

Bookkeeping

(Co-11x)

Financial statements are an important source of information to the business executive. The job of building up and keeping up-to-date the financial transactions of a business concern falls on the shoulders of the bookkeeper. He is in a position to know the inner workings of the business. This gives him an advantage over his fellow-workers in the race for success which is limited only by his own capabilities. The demand for expert bookkeepers is ever increasing. Every line of business requires such service.

Many thousands of business men who have become managers or superintendents, or have qualified for other responsible executive positions, started their careers as bookkeepers.

The student who finishes this course is fully prepared to execute efficiently the duties of a bookkeeper in any branch of business.

Topics Covered in This Course:

BOOKKEEPING (Co-10)—Bookkeeping and Accounting—Single entry. Double entry. Accounts. Cash accounts. Personal accounts. Accounts with customers. Accounts with creditors. Merchandise accounts. Inventory account. Sales account. Expense account. Profit and Loss account. Recording sales and transactions. Posting. Recording in journal. Recording in sales, purchases and cash books. Statement of business. Closing the ledger.

Partnership—Outline of accounts used in partnership. Office accounts. Accounts with merchandise. Purchases accounts. Accruals and deferred items. Accrued liabilities account. Trial balance.

Corporation—Manner of organization. Type of accounts. Purchases of trade acceptance. Exhibits and schedules. Corporation bookkeeping and accounting.

Cost Accounting—Advantages of cost system. Important features of cost systems. Process method. Machine hour rate. Machinery and equipment account. Reserve for depreciation. Types of accounts. Books of account.

Business Arithmetic

(Co-2x)

To be successful in business one must know how to figure transactions correctly. "Couldn't figure straight" is said of many men who fail. The object of this course is to give the student the essential knowledge he will require whether he works as a salesman, an office man, or in some other capacity. The lessons deal with the work of private accounts, private business, corporations, and banks.

The business man or student studying this course will acquire a practical knowledge of the fundamental arithmetical principles governing every business transaction.

Topics Covered in This Course:

BUSINESS ARITHMETIC (Co-11)—Fundamentals—United States money. Simple problems in accounting. Fractions. Decimals. Various problems involving measurements. Percentage and its application to business.

Partnerships—Arithmetical calculations and simple problems in bookkeeping involved in joint ownership.

Banking—Interest. Bank discount. Partial payments. Bankers' daily balances. Savings bank accounts. Exchange.

Business—Bills and accounts. Cash balance. Equation of accounts. Dividends and investments. Brokerage. Insurance. Taxes. Customs duties. Trade acceptance.

Business Law

(Co-10x)

Every executive, accountant or bookkeeper must have a good, practical knowledge of commercial law in order to carry out efficiently the duties of the position. And such knowledge is almost as important to the stenographer, private secretary or clerk, for almost every day these men deal with some matter that involves a principle of business law. A young man should be proud to handle such transactions wisely.

All of the principal divisions of Business Law are gone into thoroughly and clearly, giving the student a sure, practical knowledge of the subject.

Topics Covered in This Course:

BUSINESS LAW (Co-1)—Formation of contracts. Agreement. Competent parties. Operation and discharge of contracts. Assignment of contracts. Discharge in bankruptcy.

Particular Contracts Concerning Goods—Sales of goods. Duties of seller. Duties of buyer. Bailment of goods. Common carriers of goods. Insurance contracts.

Particular Contracts Concerning Credits—Credits and loans. Contract of guaranty. Kinds of negotiable instruments. Maker's and acceptor's contract. Drawer's and indorser's contract.

Conduct of Business Through Representative—Principal and agent. Obligations of principal and agent to each other. Liability of principal and agent to third parties. Master and servant.

Business Associations—Forms of conducting business. Partnerships. Joint stock companies. Corporations. Definitions and classification. Organization and powers. Rights and liabilities of stockholders.

Property in Land and Movables.—Estates in real property. Land. Relative rights of adjoining owners. Mortgages and liens. Landlord and tenant. Personal property. Kinds of estates. Acquisition and transfer.

Secretarial

(Co-22x)

This course is planned to prepare the student for a responsible and lucrative position as stenographer or private secretary. Business executives place great trust and confidence in their secretaries who daily come in contact with important and confidential matters that relate directly to the operation of the business. If the secretary justifies this trust he is well on his way to the top.

Good secretaries are so scarce that every day in every section of the country there are calls for men with thorough secretarial training, and the salaries are commensurate with the responsibility attached to the work.

The success of this course is shown by the number of men who have advanced to better positions after studying this subject under Y.M.C.A. instruction.

Every phase of secretarial work is taught in a result-getting manner, thoroughly preparing you to perform all the duties of a secretary with the ability that would take years of experience to acquire without this training.

Subjects Covered in This Course:

***GREGG SHORTHAND** (Co-14)—A light-line system. No shading. No dots, dashes or position writing. Practice in accuracy. Practice in speed.

***ISAAC PITMAN SHORTHAND** (Co-19)—The original system of phonography. Practice in speed. Practice in accuracy. Building up a complete vocabulary.

***GRAHAM SHORTHAND** (Co-18)—Building up a complete working knowledge of the system. Practice in accuracy. Practice in speed.

TYPEWRITING (Co-13)—Mastery of the keyboard. Typewriting technique. Accuracy drills. Speed drills. Correspondence.

At the time he enrolls, the student should specify what make of typewriter he intends to use.

BUSINESS ENGLISH AND CORRESPONDENCE (Co-15)—Word study. Substance and style of business English. Clearness and correctness in sentence structure. Force in sentence structure. Mechanical make-up of letter. Types of business letter. Telegrams. Cablegrams.

When the character of the student's work to this point justifies a more advanced subject, Business English and Correspondence (Co-9) will be substituted for Business English and Correspondence (Co-15).

PENMANSHIP (Co-12)—Correct positions in writing. Definition of movement. Rapid, plain, coarse-pen, muscular-movement writing for business or social use.

BUSINESS LAW (Co-1)—Principles of contract. Operation and discharge of contracts. Contracts concerning goods. Bailment of goods. Contracts concerning credits. Conduct of business through representatives. Partnerships. Corporations. Real property. Personal property.

**Only one of these subjects will be supplied. Unless student specifies otherwise, Gregg Shorthand will be sent.*

Accountancy Course the Acme of Accomplishment

The course in Accountancy for which I am enrolled has proven intensely interesting and the celerity and precision with which each successive step has been presented is surely the acme of accomplishment in so far as correspondence instruction is concerned.

Respectfully yours,

REGINALD H. HAIGH,
Knox, Indiana.

Shorthand

Thousands of men and women have used stenography as a stepping stone to success. The stenographer absorbs a great amount of essential business information that he can capitalize into a bigger job and increased pay. To the ambitious, capable stenographer advancement comes fast.

Shorthand may be mastered readily by the correspondence method. This is clearly shown by the records of successful students. The three best known systems—Isaac Pitman, Graham and Gregg—are taught by the United Y.M.C.A. Schools in the most thorough, up-to-date manner. The student may choose the style of shorthand he wishes to learn. Five or six months are usually required to master completely the principles of shorthand. By that time a student should be able to take from 90 to 120 words a minute.

Isaac Pitman Shorthand

(Co-23x)

This system of shorthand is the original one that has been in use a hundred years or more. Its extreme thoroughness makes it especially good for the court reporter and others who do exacting work.

ISAAC PITMAN SHORTHAND (Co-19)—The original system of phonography. Practice in speed. Practice in accuracy. Building up a complete vocabulary. Speed Practice.

Graham Shorthand

(Co-24x)

The Graham system is a modification of the Isaac Pitman system. Older principles have been made more simple. It holds great popularity among the expert writers and is endorsed by the National Shorthand Reporters' Association.

GRAHAM SHORTHAND (Co-18)—Building up a complete working knowledge of the system. Practice in accuracy. Practice in speed.

Gregg Shorthand

(Co-4x)

The Gregg system is a legible, simple and rapid style of shorthand. It is easy to learn, easy to read, easy to write, and has great speed possibilities. The world's championship for speed and accuracy is held by a Gregg Shorthand writer.

GREGG SHORTHAND (Co-14)—A light-line system. No shading. No dots, dashes, or position writing. Practice in accuracy. Practice in speed

Typewriting

(Co-5x)

The earning power of the stenographer, secretary, correspondent, or office clerk is directly affected by his or her ability as a typist. The typewriter is now used so extensively that the ability to operate it rapidly and accurately is a distinct asset.

This course is taught in a practical way. By easy stages the student is trained so that he derives the best and quickest results from his practice. The all-finger touch system is taught, enabling the student to write without looking at the keyboard. Mastery of all standard machines is assured.

Topics Covered in This Course:

TYPEWRITING (Co-13)—Mastery of the keyboard. Typewriting technique. Accuracy drills. Speed drills. Business correspondence. Tabulating and billing. Legal manuscripts. Business papers. Speed and accuracy tests.

At the time he enrolls the student should specify what make of typewriter he intends to use.

Business English and Correspondence

(Co-6x)

The ability to spell correctly, punctuate, and compose well helps much to make business progress more certain. Thousands of men who possess ability and a knowledge of their work do not reach the peak of success because they lack the ability to translate their ideas into clear, correctly formed sentences that carry conviction and sincerity. This course will help you to become proficient in Business English and Correspondence.

Topics Covered in This Course:

BUSINESS ENGLISH AND CORRESPONDENCE (Co-15)—The Sentence and Parts of Speech—Definitions. Kinds of sentences. Examples of sentences. Parts of speech. Nouns defined. Classes of nouns. Errors in use of nouns. Pronouns and their proper use. Verbs—kinds and correct usage. Infinitives and participles: Misused verbs. Common errors to be avoided. Adjectives—classes. Correct uses. Common errors. Adverbs—classes. Errors. Conjunctions—kinds. Wrong uses. Prepositions. Correct and incorrect uses.

Modifications of Parts of Speech—Of nouns and pronouns. Number. Rules for plural of nouns. Foreign nouns. Person and gender defined. Ways of distinguishing gender. Case—definition and classes. Personal pronouns. Correct forms. Comparison of adjectives. Correct use of the adverb. Split infinitive. Verbs—voice, mode, tense, person, number. Correct uses of shall, will, should and would. Conjugation of verbs.

The Sentence—Classes of sentences. Modifiers. Kinds of phrases. Kinds of clauses. Construction of noun classes. Forms of sentences.

Punctuation—The period. Correct and faulty use of period. Interrogation point. Exclamation point. Semicolon. Colon. Comma, its many uses. The dash. Parentheses. Brackets. Quotation marks. Rules for use of capital letters.

Applied Business Correspondence—Art and value of letter writing. Form and mechanical construction. Arranging the business letter. Titles of address. Salutation. The signature. Style of composition. Words to avoid. Effective sentences. Making the opening sentence interesting. Avoiding weak endings of letters. Outlining the letter. Brevity without weakening the letter. Making the message clear and direct. The appropriate "tone." Being fair and courteous. Avoiding generalities. Definite fact-copy. Giving the letter personality.

Kinds of Letters—Letters of application. Of inquiry. Containing inclosures. Ordering goods. Collection letters. Form letters. Telegrams and cablegrams.

Advanced Business English and Correspondence

(Co-12x)

Your words advertise you. The power to express thoughts in a clear, forceful manner helps to advancement and more pay. Every year many men fall out of the race for success; they have ability and a knowledge of their business, but they cannot express their ideas; they lack a good vocabulary and the confidence that goes with it. On the other hand, men have risen to important heights in business almost entirely by their ability to present their thoughts and other men's thoughts in clear, forceful language, yet they had no more brains and native ability than their fellows. You can by study of this course learn to talk effectively, and to write good English.

Topics Covered in This Course:

BUSINESS ENGLISH AND CORRESPONDENCE (Co-9)—**Essentials of Business English**—Substance and style of business English. Talking the "business man's language." Making sentences clear by unity and coherence. Correctness in sentence structure. Correctness of diction. Using the right word in the right place. Words commonly misused. Force in sentence structure. Placing words to effect emphasis. Emphasis by repetition. Balanced sentences. Force in diction. Saying things definitely. Simplicity of expression. Building the paragraph.

Business Forms and Usages—Standard of business usage. Correct stationery. Mechanical make-up of letter. Official and social forms. Remittances. Telegrams and cablegrams.

Business Correspondence—Essential qualities of business letters. Adapting language to the reader. Planning and constructing letters. Routine letters. Inquiries. Orders. Claims and adjustments. Collection letters. Kinds of appeals. Applications and recommendations.

Sales Letters and Advertising—The sales letter. Its functions. Attracting attention. Arousing interest. Creating desire. Influencing action. Appeals to various classes. Letters to dealers. To business men as consumers. To professional men. To farmers. To women. Follow-up letters. Advertising copy. Reports. Business narrative. Handling correspondence. Filing. Legal points.

Penmanship

(Co-3x)

In business and in social life the neat, clean-cut man is always the winner. Good penmanship contributes to this qualification. Many young men of real ability lose good opportunities because they write in a scratchy, scrawly manner that advertises them as bunglers. This course will positively make good penmen of all who faithfully follow the instruction for a short time.

Topics Covered in This Course:

PENMANSHIP (Co-12)—Correct posture. Relaxing exercises. Movement practice. Penholding. How to develop muscular movement. Form building. Practice and drills for perfecting writing. How to write swiftly without gripping the pen or tiring the fingers.

Banking

(Co-17x)

Today the banking field is very attractive, for almost every town and village has its bank, and larger cities have a score or more. The splendid dividend showing made by bank stocks generally, indicates clearly the profits made by a well-conducted bank. Banks furnish many well-paid pleasant positions that give a young man prominence and respect.

From this course the student acquires a comprehensive knowledge of the most modern banking methods. Bank bookkeeping, the close relationship of banking to the economic world, and banking administration are gone into thoroughly.

The course prepares a student for entering the employ of a bank, and gives him valuable knowledge of the jobs higher up. It is also a course well adapted to the needs of the bank clerk who is working for advancement.

Topics Covered in This Course:

BANKING (Co-17)—**Banks and Their Organization**—Methods of incorporation and organization. Classes of banks. Trust companies. Model by-laws. Bank managers. Officers of bank. Problems of bank management. Legal problems in bank management. The loaning function.

Business of a Bank—Receiving function. Receiving teller's work. Mail teller's work. Paying teller's work. Clearing. Transferring money. Operations of transit department. Duties of collection department.

Internal Organization—World exchange. Methods of handling foreign exchange. Accumulating exchange. Selling exchange. Extending credit. Loans and discounts. Banks as fiduciary agents. The bank as personal or business representative. Advisory functions.

Bank Accounting—Keeping individual ledgers. Essential books for bank accounting. Functions of general ledger. Forms of accounts. Nature of bank audits. Forms of examinations.

Banking Law—Kinds of negotiable instruments. What a negotiable instrument must contain. Maker's and acceptor's contract. Drawer's and indorser's contract. Credits and loans. Banks and banking. Bankruptcy.

Economics of Banking—Wealth. Primary factors of production. Capital. Productive industries. Money. Banking. Economic crisis. Distribution of wealth. Consumption of wealth. Taxation.

Credits and Collections

(Co-38x)

How to collect outstanding debts, to know when, and when not, to give credit to a customer—are three of the most important features in the successful operation of business. The man who knows these essentials in business saves his firm money and worry. His salary as credit manager is large and the work puts him in line for positions higher up.

To the bookkeeper, the business executive, or any other man whose activities are confined to the field of commerce, the knowledge of Credits and Collections is a valuable asset.

Topics Covered in This Course:

CREDITS AND COLLECTIONS (Co-27)—**Collections in the Marketing Plan**—Principle of resale. Selling and reselling credit. Information from customer. Credit statement. Constructive service. Co-operation with the sales department. Effective appeals.

Collection Procedure—Early stages. Discussion. Urgent. Ultimatum. Wholesale house. Form letters. Trade acceptances.

System for a Collection Department—Collecting mail-order accounts. Instalment collections. Retail credits. Department store collections. Collection of professional accounts.

Insurance

(Co-41x)

The field of insurance offers many inducements for the young man who qualifies for this important work. The business of insurance has made phenomenal strides in the last twenty-five years, and it is bound to grow far beyond its present proportions. Among the factors tending to promote such growth are the realization of the uncertainties of fortune, unsatisfactory results with the pension system, and the menace of industrial depression.

The subject of insurance is taught thoroughly and practically, as only the most modern methods of instruction are used.

Subjects Covered in This Course:

PROPERTY INSURANCE (Co-29)—Function of insurance and the nature of the insurance contract. Legal features of insurance, including the mortgage clause. Insurance organizations. Law of agency. Nature of fire risk and special stipulations in the policy. Settlement of losses. Insurance reserves. Co-insurance. Rating and reinsurance. Fire prevention. State regulations. Marine insurance. Types of organization and risks. Marine losses. Special provision in the policy. Bonding, title and credit insurance. Minor insurance. Automobile insurance. Examination of property insurance.

LIFE INSURANCE (Co-26)—Nature and uses of life insurance. Classification of policies. Risks and rates. Mathematics of life insurance. Financial plans of life insurance. Special forms of life insurance. Organization, management and statutory regulations. Legal phases in life insurance. Accident and health insurance. Liability insurance. Workman's compensation insurance.

Life Insurance

(Co-39x)

Every man and woman in this country is a potential prospect for the life insurance agent. A man with dependents is morally compelled to take out life insurance in order to guard against all possible danger or misfortune to his family after his death. The inheritance tax levied by the government on large fortunes has caused people of wealth to take out insurance that will pay this tax.

The income of the insurance agent depends entirely upon his ability and industry. Some insurance men have incomes that average above $50,000 a year, while those with incomes of $10,000, or more, are numbered in the thousands.

Topics Covered in This Course:

LIFE INSURANCE (Co-26)—Nature and use of life insurance. Classification of policies. Risks and rates. Mathematics of life insurance. Financial plans of life insurance. Special forms of life insurance. Organization, management and statutory regulations. Legal phases of life insurance. Accident and health insurance. Liability insurance. Workman's compensation insurance.

Property Insurance

(Co-40x)

One of the best paying insurance specialties is that of insuring property. The owner of an automobile, a house, or other personal or real property should insure his possessions against possible loss. The man entering this field should have a fair education and some knowledge of the field in which he wishes to specialize.

Topics Covered in This Course:

PROPERTY INSURANCE (Co-29)—Functions of insurance and the nature of the insurance contract. Legal features of insurance including the mortgage clause. Insurance organizations and the laws of agency. Nature of fire risk. Special stipulations in the policy. Settlement of losses. Insurance reserves. Co-insurance. Rating. Reinsurance. Fire prevention. State regulations. Marine insurance. Types of organization and risks. Marine losses. Bonding, title and credit insurance. Minor insurance. Automobile insurance.

Civil Service

Every man is out to earn a good living. He desires steady employment, good working conditions and opportunity for advancement that means an increase in pay. He will find these in the Civil Service of Uncle Sam.

Good salaries, short working hours, a vacation every year with pay, and should it be necessary, sick leave with full pay, make an appointment to a position with the United States Government well worth the effort to secure.

Each year thousands of the better government positions are filled by applicants who successfully pass the first, second or third grade Civil Service examinations.

If you find that the government position you desire necessitates the passing of one of these three Civil Service examinations, you can study the required subjects by correspondence under Y.M.C.A. instruction. Past experience has proved the great value of this instruction in getting the best results in the shortest period of study.

By Comparison "Y" Instruction is Best

Civil Service Courses:

Civil Service—First Grade (Co-35x)
Civil Service—Second Grade (Co-36x)
Civil Service—Third Grade (Co-37x)
Post Office Clerk, or Carrier—(Co-25x)
Post Office Inspector—(Co-26x)
Customs Service—(Co-29x)
Stenographer and Typist—(Co-30x)
Stenographer—(Co-33x)
Typist—(Co-32x)
Bookkeeper—(Co-34x)
Railway Mail Service—(Co-28x)
Marine Inspection Service—(Co-27x)



TEXT BOOKS AND SUPPLIES
Furnished Without Extra Charge for Students of Accountancy

Without additional expense the students in nearly all courses are furnished with all the textbooks and supplies, which may be called their working tools. This is a distinctive "Y" service that means a great saving to every student.

ADMINISTRATION

Business Administration

(Co-15x)

The thousands of concerns that go into bankruptcy yearly, with liabilities running up into big figures, can, in a large proportion of cases, place their failures at the door of faulty management. Statistics show this to be true. Every man that expects to confine his life work to the field of commerce needs a knowledge of Business Administration. He is much hampered if he lacks it.

The man at the top, with such knowledge, follows closely the administration of his business, sees the faults and can correct them. The man at the bottom, looking at the job ahead, will be able to start his climb only when he comprehends the "ins and outs" of business organization.

The field for men who are expert in business management and finance is the entire commercial world. The thousands of concerns that monthly come into being offer ample opportunity for the organizer. The pay of a man in this work varies greatly with his ability. Many business administrators draw salaries away up in the thousands.

This course teaches the subjects of Business Administration in a thoroughly practical manner. Forms and illustrations drawn from large business organizations give the student a valuable knowledge of the operations in the most successful business houses.

Subjects Covered in This Course:

OFFICE MANAGEMENT (Co-7)—**Principles of Office Administration**—Field of office manager. Office function. Making of office manager. Development of modern office. Departmental and unit methods of organization. Analysis of functions and duties.

Location, Layout, Equipment—Selection of an office. Leasing an office. Layout and flow of work. Factors of time and space in judging efficiency. Routing and scheduling. Labor saving devices in office. Effect of new methods. Rapidity of production. Desk and dispatch of work. Planning a big sales campaign.

Methodizing the Means of Communication—Handling office mail. Importance of mail department. Labor saving devices. Organization of messenger service. Need of messenger service. Routing and filling orders. Filing. Work of filing department. Filing systems. Filing standardization and centralization.

Control of Correspondence and Related Activities—Stenographic department. Equipment. Organization. Standardization of stenograhic work. Measurement of stenographic output. Methods of controlling output. Handling office detail.

Work of Business Departments—Purchases and stores. Work of traffic department. Handling credits, collections, complaints. Sphere of sales management. Relation of sales to advertising and promotion work. Methods of marketing. Home office control of sales. Reward and training of salesmen. Work of sales promotion department. Work of advertising department. Organization of accounting department. Control of accounting activities.

Training and Development of Office Workers—Selection. Training and education of right employees. Organization of office training school. Outlining course of study. Language of business writing. Speech. System of training. Language of executive. Art of expression. Dictating conversation.

Organization and Management—Building and equipment of factory. Importance of selection of building site. Accessibility. Available labor supply. Wholesale and retail locations. Problems of management. The line organization. Duties of foreman. Motion study. Human factor. Wage question. Standardized conditions. Relation of workman to employer.

BUSINESS ENGLISH AND CORRESPONDENCE (Co-9)—Parts of speech. Punctuation. Style of business English. Correctness and force in sentence structure. Correctness and force in dictation. Business forms and usages. Mechanical make-up of letter. Official and social forms. Essential qualities of business letter. Construction of letter. Routine letters. Claims and adjustment letters. Collection letters. Sales letters. Follow-up letters. Advertising copy. Business narrative. Filing systems.

BUSINESS FINANCE (Co-8)—Principles of financing. Enterprises. Owned capital. Borrowed capital. Basis of capitalization. Sources of capital funds. Investment of capital funds. Determination of net income. Internal financial management. Exploitation by officers. Exploitation by directors and shareholders. Insolvency. Receivership. Reorganization.

BUSINESS LAW (Co-1)—Definition of contract. Essentials of enforceable contract. Classes of agreements. Competent parties. Contracts under seal. Operation and discharge of contracts. Contracts concerning sale of goods. Bailment of goods. Insurance contracts. Contracts concerning credits. Negotiable instruments. Conduct of business through representatives. Business associations. Partnerships. Joint stock companies. Corporations. Property in land and movables. Personal property.

BUSINESS ECONOMICS (Co-5)—Underlying conditions of national prosperity. Primary factors of production, labor, power, land, capital. Productive industries. First law of the market. Relation of utility to value. Banking. Marketing. "Free-trade." "Protectionism." Distribution of wealth. Wages. Labor organization. Rent of land. Source of interest. Cost of capital. Profits. Consumption of wealth. Rational consumption. Luxury. Taxation. Financing of war. Communism. Socialism. Anarchism. Constructive liberalism.

BOOKKEEPING (Co-10)—Bookkeeping and accounting terms. Cash account. Personal account. Accounts with creditors. Inventory account. Sales account. Expense account. Recording transactions. Posting. Ledger. Partnership. Reserve for depreciation. Accruals and deferred items. Accrued liabilities account. Profit and loss account. Trading account. Corporation. Surplus. Advertising account. Cost accounting. Systems. Books of account. Single entry bookkeeping. Double entry bookkeeping.

Business Economics

(Co-7x)

The causes of depression in commerce, the why and wherefore of labor troubles, the laws of relationship between government and business—these are factors in our life with which every man should be conversant. A keen insight into public affairs and an understanding of the causes of panic and prosperity help a business man to control the operations of his business with a greater certainty of success. Ignorance of internal and external affairs, and their influence on every day business, has driven thousands of concerns to the wall. This course goes thoroughly and interestingly into every detail of this subject, giving the student a broad knowledge of the fundamentals of sound business.

Topics Covered in This Course:

BUSINESS ECONOMICS (Co-5)—**Underlying Conditions of National Prosperity**—Economy. Wealth and well being. Self interest. Competition. Law and government. Morals and religion. Geographical situation.

Production—Primary factors. Quality of people. Division of labor. Power. Land. Capital. Organization of business. Balancing of factors of production. Manufacturing industries. Merchandising. Personal and professional service.

Exchange—Law of variable proportions. Nature of wage question. What determines rate of wages. Labor organizations. Rent of land. Source of interest. Cost of capital. Profits.

Consumption of Wealth—Meaning and importance of consumption. Rational consumption. Luxury. Control of consumption.

Public Finance—Taxation. Financing of war. Earmarks of good revenue system.

Reform—Communism. Socialism. Anarchism. Single tax. Constructive liberalism.

Business Finance

(Co-13x)

Business success these days depends to a large extent on sound organization. This very compact course gives an intimate knowledge of the duties of a business organizer or financial manager of an enterprise. The instruction is replete with just the kind of information needed by one interested in organizing, financing and managing, and who aspires to the position of department head or general executive. The world needs men with such knowledge.

Topics Covered in This Course:

BUSINESS FINANCE (Co-8)—**Finance and Business Organization**—Principles of financing. Types of business organization. Sole proprietorship. Partnership. Corporation. Types and purposes. Rights and duties of shareholders. Advantages and disadvantages.

Capital—Owned capital. Borrowed capital. Basis of capitalization. Notes. Bonds. Mortgages.

Securing Capital—Sources of capital funds Promoter. Promoting combinations. Selling securities. Underwriting.

Internal Financial Management—Investment of capital funds. Calculating requirements for working capital. Determination of net income. Dividends. Surplus. Budgets. Financial standards.

Financial Abuses and Involvements—Exploitation by officers. Exploitation by directors and majority shareholders. Insolvency and receivership. Reorganization.

The United Y.M.C.A. Schools, with spare-hour classes in hundreds of cities, and with a well-organized division of correspondence instruction, can bring to you the advantages given in the past year to over 140,000 *young men.*

Business Organization

(Co-21x)

Sooner or later the law of the survival of the fittest operates in every office. The man who is trained goes ahead, while the man who lives in to-day and forgets to-morrow will lose his job.

Whether you are a bookkeeper, a stenographer, a department head, or even an office manager, if you understand well the administrative and financial methods as practiced by the best business organizations, and know how to put your knowledge to work, there is no limit to your advancement.

This course goes deeply into the subjects of office management and business finance, and prepares the student to handle efficiently even the most difficult problems met with by the office executive.

Subjects Covered in This Course:

OFFICE MANAGEMENT (Co-7)—Principles of office administration. Selection of an office. Layout and flow of work. Labor saving devices. Methodizing means of communication. Control of correspondence and related activities. Handling office detail. Work of business departments, advertising, accounting, sales. Training and developing of office workers. Business writing. Business speech.

BUSINESS FINANCE (Co-8)—Principles of financing. Forms of business enterprise. Owned capital. Borrowed capital. Sources of capital funds. Investment of capital funds. Internal financial management. Exploitation by officers. Exploitation by directors. Insolvency. Receivership. Reorganization.

Office Management

(Co-14x)

The thousands upon thousands of business houses in this country must each have a man at the head of its office affairs who can direct the administration of the business. He stands pre-eminent, his work is interesting, his opportunities for advancement many, and his pay is large. Office managers draw $150 monthly up to $1000 and more, depending on their ability and the size of the organization.

Every bookkeeper, file-clerk, stenographer, mail-clerk and correspondent, ambitious to start on his way to the top, should get a clear insight into the duties of office executive.

Topics Covered in This Course:

OFFICE MANAGEMENT (Co-7)—**Principles of Office Administration**—Field of the office manager. Development of the modern office. Departmental and unit methods of organization. Analysis of functions and duties.

Location, Layout and Equipment—Selection of an office. Leasing an office. Layout and flow of work. Labor saving devices in the office. Modern efficiency desk. Dispatch of work.

Methodizing Means of Communication—Handling the office mail. Organization of a messenger service. Routine of filling orders. Filing.

Control of Correspondence and Related Activities—Stenographic department. Standardization of stenographic work. Measurement of stenographic output. Handling the office detail.

Work of Business Departments—Purchases and stores. Work of the traffic department. Handling credits and collections. Sphere of sales management. Home office control of sales. Training of salesmen. Work of sales promotion department. Advertising department. Organization of accounting department. Control of accounting activities.

Training and Development of Office Workers—Selection of the right employee. Training and education of employees. Language of business. Writing. Speech. Language of the executive.

Course in Business Management Helped Him Increase Business 75 Per Cent.

Since taking your course in Business Management I have purchased a drug store in New Jersey, and have been using with much success a good many of the methods explained to me—so much so that I have increased the business 75 per cent. in the short time of two months—a remarkable showing!

The details of installation, and everything that goes with a new proposition, are the real reasons for my temporary vacation from my studies, but I can see that I cannot afford to let anything come between me and the completion of my course. I have found the information gained very necessary to the success of modern business.—(*Name on request.*)

Knowledge Pays Big Dividends

Applied Psychology

(Ac-26x)

Psychology is a systematic knowledge of the mind that has proved to be one of the most vital factors in assisting a man to accomplish what he sets out to do. The application of psychology to everyday affairs was made possible by the common-sense experiments of such noted scientists as Hugo Munsterberg and William James. Their lucid explanations of psycho-phenomena brought this science within the sphere of the average intellect. A powerful tool for shaping success was placed at the command of man. The salesman, the executive, the office man, in fact every person should have a practical knowledge of psychology as applied to his work, if he is to get the most out of life.

There are no hazy hard-to-understand theories in this course, which is taught by Burt B. Farnsworth, a specialist in psychology whose experience extends over a period of thirty years. Each phase of the subject is covered in a simple, understandable way that gives the student a working knowledge which he can apply to everyday affairs.

Topics Covered in This Course:

APPLIED PSYCHOLOGY (Ac-31)—Application to Daily Uses—Mental mastery. Relation of mind and body. Control of bodily activity. Cell theory of life. Human nervous system. Association centers. Consciousness.

Sense-Perceptive Processes—Sensation. Perception. Interpreting impressions. Sense perception. Cause of illusions. Special senses. Sensory qualities.

Concepts and Judgment—Relation of percepts to concepts. Conception. Analysis and synthesis. Growth of intellect. Language. Judgment. Training judgment.

World of Association—Reaction time. Association areas. Cause of association. Similarity. Difference. Power of association. Subconscious association. Dissociation.

Memory—Good memory. Poor memory. Forgetting. Basis of memory. Types of memory.

Imagination—Kinds of images. Color. Sound. Taste. Smell. Feeling. Motion. Form. Heat. Cold. Images and percepts. Beliefs. Ideas. Imagination and environment. Control of imagination. Constructive imagination. Power of imagination. Limits of imagination.

The Reason or How We Think—Day dreaming. Rationalization. Constructive thinking. Instinctive action. Experience. Information. Intelligence. Poor thinking. Difficulties. Cause of thought. Thought processes. Original thought. Acquisitive and reflective powers. Inductive reasoning. Beginning of thought. Necessary beliefs. Judgment and thinking. Laws of thinking. Intuition. Arrested thinking. Why men differ in their thinking.

Will and Perseverance—What will is. How to train the will. Relation to habit. Formation of habit. Breaking of habits. Relation of perseverance to will. Relation of will to fatigue. Causes of fatigue. How to eliminate fatigue.

Interest and Attention—Physical basis of interest. How to develop interest. How to control interest. How to strengthen old interests. Voluntary and involuntary attention. Increase of nerve energy through attention. How to increase attention.

Mental Mastery—Relation of mind and body. Meaning of mental mastery. Importance of knowing mental processes. Relation of mental mastery to fine physique.

Psychotherapy—Misunderstandings. Meaning. Power of suggestion. Controlling body through mind. Functional disorders. Mental mastery through suggestion. Impulsive and conscious control. Meaning of impulse. Impulse and instinct. Instinct and habit. Habit and reflection.

Temperaments — Four temperaments. How temperaments are modified. Importance of knowing temperaments. How to check outstanding qualities of temperaments. How to brace up weaker temperaments. Relation of normal to abnormal in temperaments.

Success—Meaning of success. Elements essential to it. Raw materials out of which it is built. Success in apparent failures. Outstanding qualities of men who have attained success in your field. Handicaps. How handicaps may be overcome.

Tokio Y.M.C.A. Secretary Applies Acid Test to Correspondence Instruction

It may seem strange for a Y.M.C.A. Secretary to take the course which I am taking (Business Organization) but I am trying to find out by experience how you handle this sort of correspondence business.

Let me say that your letter has demonstrated to me that the Student Service Department of the United Y.M.C.A. Schools is what it is claimed to be—the personal contact between the school and the student.—W. R. F. STIER, Tokyo, Japan.

Says "Y" Course in Business Administration Saved Him Hundreds of Dollars

Your course in Business Administration has been a great help to me in my every day business. I consider that the ideas that I conceived due to taking your course, have saved me hundreds of dollars.—ELIAS K. KHALOUF, 535 Philadelphia Street, Indiana, Pa.

Invest in Education—It Pays Big Dividends





S. ROLAND HALL

"PRODUCE Business," says the employer of today. "What we want are orders, a large circle of customers and friends. The person who can really help us to produce more business is the one who interests us."

"Business building" is a broad term. It includes every kind of effort that gains and retains trade, whether it be printed salesmanship in the pages of newspapers or magazines; the use of booklets, catalogs or letters; sales effort behind the counter or on the road; show cards, signs or store displays; a good knowledge of business law that safeguards transactions, or an understanding of mental laws that enables a man to know not only how to get the best result from his own effort, but also how to deal more intelligently and effectively with his fellow men.

The fine thing about the great business field is that the man who enters it is not hampered by an ancient code of ethics that prevents him from going out and making a place for himself. Neither is he held back by time-honored precedent which makes it necessary for someone else to die or be promoted before advancement is possible.

No, the man who has acquired a knowledge of advertising, salesmanship, better letter-writing, show-card writing, or merchandise display, is free to step out into the marts of commerce and make his way with the assurance that the employing world stands ready to pay him according to his productiveness.

With the Y.M.C.A.'s rich experience in almost all forms of promotional effort as a background, the Extension Division takes pride and pleasure in making available to ambitious men and women a variety of courses in business building that will meet the many different needs and ambitions.

Experienced Instructors to Guide You

S. Roland Hall, author of the new Advertising Handbook, which is one of the textbooks used in the Advertising Course, has had fifteen years' experience as principal with a prominent correspondence school, and advertising manager for the Victor Talking Machine Company and Alpha Portland Cement Company. He now heads his own business as advertising counselor and agent. Mr. Hall takes part in the functioning of this School in an advisory capacity.

The head of the Business Building Department, R. Earle Williamson, is particularly well qualified by experience and study to make these courses a success. His experience covers the fields of advertising and selling. He has held positions as sales correspondent, advertising writer and manager with such concerns as Alexander Brothers and Lanston Monotype Machine Company of Philadelphia, and the Mergenthaler Linotype Company of New York. Supplementing this broad practical experience in the field of advertising and selling, he has taken special training in his chosen work at such representative institutions as the University of Pennsylvania, New York University, and Columbia University.



R. EARLE WILLIAMSON

A Lesson in Advertising



Prepared by Charles W. Smith
Waynesboro, Va.

Mr. Smith is a student both in our Advertising and Commercial Illustrating Courses

E. H. Lewis, instructor in advertising, has spent over twenty years in newspaper and advertising work. He has served successfully in all capacities in newspaper making from "printer's devil" to advertising solicitor, publisher and editor. In addition he was for more than eight years instructor in advertising with a prominent correspondence school.

Assisting these capable men is a corps of experienced instructors, each of whom desires to have every student succeed.

Advertising

(Ad-1x)

A great force in Business—The field of advertising makes the keen young man of to-day enthusiastic, for it opens to him a most interesting type of occupation. The capable advertising man stands out. His every effort advertises him and aids in his advancement. Advertising brings him into contact with manufacturers and merchants, publishers and printers, illustrators and engravers. It affords opportunity for research, and enables him to analyze, plan, and write—a varied occupation that brings out creative ability.

Advertising plays a marvelous part in our lives. It is perhaps the greatest modern commercial force. It creates world-wide desire for new products. It maintains and increases the demand for things already known. It changes the buying habits of people, and educates them to the use of things that make home life more attractive. It raises the standards of living, and teaches how to get and keep good health. As a means of selling goods, spreading ideas, building good will, and prompting prosperity, the usefulness of advertising can scarcely be overestimated.

Advertising makes us acquainted with certain standard well known products and keeps us constantly reminded of them. Business expands, commerce grows, new firms organize. Things are continually being invented that must be made and sold. Each item of development means a proportionate expansion in advertising. The demand for trained advertising men is constant. Certain it is that advertising will keep on expanding and calling for more and more men and women qualified in publicity methods.

Advertising men get big salaries. Many earn $3,000 to $5,000 a year. Others receive as much as $10,000 to $25,000. As an advertising man your progress and income depend on your ambition and how well you develop and use your talents. Your earnings will not be governed by what others receive.

So general has advertising become that even stores in small cities and towns have specially trained men and women to plan and prepare the various kinds of publicity required. So keen is the competition among retailers that they pay good salaries to men and women who can increase their sales.

Advertising is pleasant and interesting. There are many things to write about in different ways, and the many forms of advertising permit you to specialize in one kind of publicity, or to be as versatile as you can.

You may conduct an advertising company or agency of your own. You may enter an agency and become a well paid copy writer or plan man. You may advance to the advertising managership of a manufacturing concern, or occupy a like position on a newspaper, calling on buyers of space and aiding them to use their space effectively. You may be a free lance, do such work for others as you prefer, and charge what your services are worth. Many men and women are doing well in this independent advertising field.

If you are a store clerk, learn advertising and get from behind the counter into a better paying position. If you are tired of sitting at an office desk, why not leave monotonous routine behind and enter this creative field? If you are dissatisfied with your present work and chances for advancement, learn advertising.

The success of Y.M.C.A. instruction is proved by the large number of former students who are holding responsible, well paid positions in this profession. A careful study of the subjects outlined below will give you a good idea of the thorough training to be expected from the study of this course.

Topics Covered in This Course:

ADVERTISING (Ad-1)—A powerful business force. Development. Use. Relation to business and society. Educational and economic effects. Gathering data. Studying the product, market, conditions, people; their needs, wants, traits, and buying habits. Dealer's attitude. Competition. Psychology applied to advertising. Campaigns—local, national.

Advertising Copy—Importance. Kinds—reminding, informing. Types of appeals—commanding, declarative, persuasive. Arousing interest. Creating desire. Influencing action. Appeals to imagination and the senses; to sentiments and emotions. Suggestion. Reasoning. Applying psychology to copy. Association of ideas. Positive and negative appeals. Value of repetition. Instincts. Motives. Laws of contiguity, sequence and feeling tone. Constructing copy—composition, style, originality. Using words effectively. Making copy clear and concise. Copy as affected by medium, by display. Copy for newspaper advertisements, for general magazines, for catalogues, for street-car cards, house organs. Advertising to farmers, business men, technical and professional workers, women and children. Creating headings and sub-headings.

Typography of Advertisements—Making the layout. Lettering display lines. Dummies for catalogues, booklets, and folders. Engravings. Printing methods. Kinds of paper. Display elements and how to use them. Kinds of display. Attracting attention. Emphasis by contrast. Importance of white space. Balance in display. Choosing types and borders. Making ads easy to read. Hand-lettered ads. Display as influenced by copy, by medium, by the thing advertised.

Illustration—Appeals of pictures to create favorable impression, arouse interest and create desire. Showing the product and how to use it. Re-enforcing copy with suggestive pictures. Emphasizing the package. Syndicate and stock cuts. Illustrations from photographs and drawings. Half-tones and line cuts. Pictures in color. Placing illustrations to advantage. Cost of drawings.

Retail Advertising—Adapting copy to "average" buyer. Advertising manager and his work. Getting information from buyers and salespeople. Sales events. News in advertising. Bargain advertising. Typographic style.

Medium—Value. Newspapers. General magazines. Class magazines. Trade journals. Posters. Bulletins. Street-car cards. House organs. Programs.

House Organs—Kinds. Copy. Editing. Compiling mailing lists. Costs.

Direct-By-Mail Advertising—Catalogues, booklets, folders, mailing cards, circulars, "broadsides," letters, etc. Distribution. Choosing paper. Cover papers. Book papers. Cover designs. Color harmony. The "dummy." Choosing types, borders, ornaments. Handling proofs.

Mail Order Advertising—General, special. Copy. Display. Follow-ups. Records. Checking results. Letters and follow-up systems.

Street-Car Advertising—Aids to other advertising. Population reached. Right copy. Designs. Use of colors.

Outdoor Advertising—Posters. Painted boards. Bulletins. Illuminated display.

Miscellaneous—Moving pictures. Directories. Calendars. Programs. Slogans. Trade names. Trade-marks. Labels. Dealer aids. The agency and its work. Laws affecting advertising. Proofreading and editing.

***BUSINESS ENGLISH AND CORRESPONDENCE** (Co-15)—Word study. Common errors. Analysis and classification of sentences. Punctuation. Capitalization. Correspondence. Composition of business letter. How to construct effective sentences. Brevity and clearness. Completeness. Letter of application. Letters of inquiry. Collection letters. Form letters. Telegrams and cablegrams.

***ADVANCED BUSINESS ENGLISH AND CORRESPONDENCE** (Co-9)—Style of business English. Correctness and force in sentence structure. Correctness and force in dictation. Business forms and usages. Mechanical make-up of letter. Official and social forms. Essential qualities of business letter. Construction of letter. Routine letters. Claims and adjustment letters. Collection letters. Sales letters. Follow-up letters. Business narrative. Filing systems.

**Optional.* *(See Page 12.)*

Attributes His Promotion to "Y" Course in Advertising

You will notice from my correspondence recently that I have been put in charge of the advertising of this company, which is a very large concern, owning over eighty retail lumber yards in Montana. It has the promise of developing into an extremely good proposition if our advertising this year is successful.

I feel that I have derived so much benefit from my present course that it behooves me to continue my studies. As I am now nearing the completion of my course, I am thinking about what I shall take up next.

I once told you that I wished a chance to stand or fall by my efforts in advertising and I have that opportunity now. If I don't succeed it will be my own fault. If I do succeed (and, by George, I'm going to) the United Y.M.C.A. Schools will be largely responsible.—J. E. TRACEY, Great Falls, Montana.

Advertising Manager Endorses Y.M.C.A. Instruction

I say now and somewhat with pride that I am now the Advertising Manager of my company. I have worked hard for this position and was "knighted" Advertising Manager last week. With a skilled and energetic force I expect to show results, thanks to my efforts and to the instruction of the United Y.M.C.A. Schools.—ELMER BRANDELL, Louisville, Kentucky.

Course Aids Salesman of Nationally Known Concern

I am now employed as a salesman for the National Cash Register Company. Have been on the road the greater part of last three months. My course in Salesmanship has helped me in a great many ways and I highly recommend it to anyone.—P. H. LIBBY, Portland, Me.

Salesmanship

(Ad-3x)

Every man who intends to enter business or to engage in promotion work of any kind needs a knowledge of salesmanship. The principles of salesmanship are exceedingly broad in their application. For example, one attempting to form a new club, to manage a political campaign, or to act as chairman of a committee, has as great a need for a knowledge of scientific salesmanship as the salesman who has the job of selling life insurance or adding machines. The practice of salesmanship may, therefore, be said to be a preparation for leadership. No man ever became a success as a salesman without becoming a bigger man, better able to understand, deal with and direct his fellowmen.

If a man is planning to have a business of his own some day, training in salesmanship and experience in selling afford the very best kind of preparation, for the success of a business enterprise depends on the way it is promoted. Salesmanship as a profession takes its stand as the most important factor in business. It is the salesman that must feed the machinery of production with the orders necessary to keep the wheels of industry turning.

This course gives a simple, orderly presentation of the general science of selling. It includes all branches, from the simplest retail selling to the most highly specialized traveling salesmanship. It gives the student in a practical, interesting way the net results of the experience of thousands of expert salesmen. It offers information that one would be years learning through his personal experience. Our plan of teaching salesmanship does not call for the reading of long, dry treatises dealing with vague theories, obscure philosophy, or fine-spun, impractical psychology. The texts are clear, man-to-man explanations, freely illustrated from incidents in every-day sales-practice.

Topics Covered in This Course:

SALESMANSHIP (Ad-2) **Salesman and His Job**—Problems of marketing goods. The training essential for salesmen. Factors in a sale. Definition of salesmanship. Physical fitness the salesman's prime asset. The sale as a mental transaction. Mastering technique of thinking. Man-power in selling. Methods of selling, wholesale, specialty, retail. Characteristics of great salesmen. Constructive habits to be cultivated.

Salesman and His Goods—Knowledge of goods is necessary to success. How to get the facts. How to build the selling talk. What the customer wants to know. Proving the value of goods. Selling ideas, not things. Making the goods desirable. Controlling the feelings.

Salesman and His Customer—Judging the customer's nature. Environment, attitudes and speech as clues to character. The salesman as the customer sees him. Salesman as a confidence maker. The man who thinks he can is the man who does. The tactics of selling. Getting through to the customer. Manner and manners in approach. Arousing the customer's interest. An interesting individuality.

Salesman and His Sale—Inducing desire to buy. Putting art into selling. Getting decision and action. Necessity for developing an active will. Using assurance. Decisiveness and authority. What objections are and why raised. Maintaining poise and power. Satisfying and utilizing the customer. Looking ahead into larger fields. Making failure the foundation for achievement.

Salesmanship and Business

(Ad-2x)

The modern salesman realizes his need for extensive training. Virtually every kind of education is useful to a salesman, for at one time or another he is called on to take part in many forms of commercial promotion, and he comes in contact with many types of people representing widely diversified interests.

In addition to a thorough grounding in salesmanship there are other kinds of knowledge that every salesman should possess. For example, the salesman frequently needs a knowledge of business law. Without it he may make faulty contracts. He may fail to see some very important point relating to credit or payment, or he may make a bad slip with reference to shipping goods.

The ability to write a fine letter may pave the way for the salesman's call on the prospective buyer, or may clinch a sale. Tactful letters, well written, preserve amicable business relations. If correctly worded they collect money at little expense, adjust claims and settle complaints. Training in business letter-writing is essential in every business.

Many salesmen fail to achieve success because they talk poorly, especially when called upon to present a proposition to a buying committee or other

group. To speak well—pleasingly and interestingly—is a wonderful help in selling and in social life. It is greatly to a person's credit in all his activities if he is able to stand and give his views in an orderly and convincing manner.

If you aim to devote your energies to the promotion of business, this is an excellent course for you. It embraces all the instruction given in the standard Y.M.C.A. Course in Salesmanship, and also the important training in Business Law, Better Letters, and Public Speaking that every salesman should have.

Subjects Covered in This Course:

SALESMANSHIP (Ad-2)—The art of salesmanship. Economies in selling. Factors in selling. Psychology in selling. Man power in selling. Keeping mentally alive. Definition of salesmanship. Methods of selling, wholesale, specialty, retail. Characteristics of great salesmen. Constructive habits to be cultivated.

Salesman and His Goods—Knowledge of goods is necessary to success. How to get the facts. How to build the selling talk. What the consumer wants to know. Proving the value of goods. Selling ideas, not things. Making the goods desirable. Controlling the feelings.

Salesman and His Customer—Judging the customer's nature. Environment, attitudes and speech as clues to character. The salesman as the customer sees him. Salesman as a confidence maker. The man who thinks he can is the man who does. The tactics of selling. Getting through to the customer. Manner and manners in approach. Arousing the customer's interest. An interesting individuality.

Salesman and His Sale—Inducing desire to buy. Putting art into selling. Getting decision and action. Necessity for developing an active will. Using assurance. Decisiveness and authority. What objections are and why raised. Maintaining poise and power. Satisfying and utilizing the customer. Looking ahead into larger fields. Making failure the foundation for achievement.

BUSINESS LAW (Co-20)—Contracts concerning goods. Sales of goods. Bailment of goods. Negotiable instruments. Essential elements of negotiable paper. Conditions of transfer. Letters of credit. Bonds. Warehouse receipts. Bills of lading. Conduct of business through representatives.

BETTER LETTERS (Co-21)—Building the letter. Effective wording. Make-up of business letter. Conventional forms. Adjustment letters. Arrangement. Building sales letters. Principles of salesmanship. Follow-up letters. What the follow-up can do. Testing letters. Correcting the mailing list. Sales campaigns. Collection letters. Credit letters.

PUBLIC SPEAKING (Lt-6)—Speech building. Developing knowledge. Gathering data. Practice in effective speaking. Learning self-control. Building personality. Voice training. Arranging the speech. How to think logically. How to speak convincingly. How to appeal to the reason, feeling, senses. Use of humorous speech. How to make people laugh. Acquiring good delivery. Developing self-expression. How to gain and hold interest. Power of first impressions. Your choice of words. How to study words. The popular speech. How to handle an audience.

Complete Letter Writing

(Co-43x)

One of the powerful forces in business is the sales letter. The man who can express his thoughts in writing in a clear, concise way that will leave the desired impression on the reader has a distinct advantage in getting business.

Concerns that do a nation-wide business cannot depend altogether on their salesmen to handle all the difficult matters that are certain to be encountered. They must rely to a great extent on letters. Thousands of potential buyers can be reached through the mails successfully at slight expense. The manufacturer's story of his product can be spread broadcast. He can keep the confidence of buyers in his product and retain their trade.

Even the small business man must know how to write good letters if he expects to reap the profits that are rightfully his. For the young man employed in a business office, letter writing is just as important. If he can write what he thinks in graphic language, his chances for getting a better position are considerably increased.

Commercial concerns, large and small, appreciate the value of good letters as business builders. They now demand men who can write them. This course supplies the training that should enable the student to make a marked improvement in his or her letter-writing.

Topics Covered in This Course:

BUSINESS ENGLISH AND CORRESPONDENCE (Co-15)—Parts of speech. Word study. Common errors. Modifications of parts of speech. Analysis and classification of sentences. Punctuation. Capitalization. Correspondence. Composition of business letter. How to construct effective sentences. Brevity and clearness. Completeness. Letter of application. Letters of inquiry. Collection letters. Form letters. Telegrams and cablegrams.

ADVANCED BUSINESS ENGLISH AND CORRESPONDENCE (Co-9)—Essentials of Business English.

Business Forms and Usages—Standard of business usage. Correct stationery. Mechanical make-up of letter. Official and social forms. Remittances. Telegrams and cablegrams.

Business Correspondence—Essential qualities of business letters. Adapting language to the reader. Planning and constructing letters. Routine letters. Inquiries. Orders. Claims and adjustments. Collection letters. Kinds of appeals. Applications and recommendations.

Sales Letters and Advertising—The sales letter. Its functions. Attracting attention. Arousing interest. Creating desire. Influencing action. Appeals to various classes. Letters to dealers. To business men as consumers. To professional men. To farmers. To women. Follow-up letters. Advertising copy. Reports. Business narrative. Handling correspondence. Filing. Legal points.

BETTER LETTERS (Co-25)—Fundamental Principles—Importance of business letters. Use of words. Acquiring a vocabulary. Parts of speech. Types of sentences. Phrasing. Principles of thinking. Punctuation.

Mechanical Aspects—Arrangement. Style. Correct formulation. Indention. Spacing. Paragraphing. Paper as an expression of individuality. Letterhead size and design. Conventional forms. Value of neatness. Correct folding. The business envelope.

Building the Letter—Unity in thought and presentation. How to secure unity and coherence. Arrangement of letter. Rules for correct formulation. Correctness in form, expression and fact. Clearness. Conciseness versus brevity. Completeness. Especial importance of courtesy.

Sales Letters—Strength and weakness of sales letters. Principles of salesmanship. Elements. Methods of approach. How to secure interest. Reader's viewpoint. Significance of "you." Building the sales argument. Illustrative letters. Answering inquiries. Classes of sales letters. Follow-up letters. Testing letters. Letter campaigns. Compiling and testing mailing lists. When and how to use form letters and paragraphs. Filing. Reports.

Adjustment Letters—How to make complaints. Adjusting complaints. "You and I" spirit. Suggesting a remedy. Illustrative adjustment letters.

Credit Letters—Securing information. Co-operation of credit with sales department. Handling trade acceptances. Withholding shipments. C. O. D. shipments. Refusing credits.

Collection Letters—Keeping customers on good terms. "You and I" spirit. Policy of service. Classes of customers. Meeting conditions. Using courtesy. Good humored appeals. Showing good will. Dignified reminders. Post office rules affecting letters.

Letters of Inquiry. Asking favors. Remittances. Letters of application. Internal letters. To salesmen. Do's and Don't's.

Better Letters

(Co-31x)

The awakening to Better Letters—Progressive business firms have awakened to the tremendous importance of the letter, not merely as a sales medium, but as a gainer and retainer of good will. It is generally recognized that no medium in business affords greater possibilities than the letter.

Today calls come from every part of the country for good correspondents, who command salaries from $100 a month up to $300, $400, and more, according to their ability and the type of work in which they are engaged.

Advertisers realize that they have only begun when they spend hundreds of thousands of dollars yearly to interest the public in their products or services—they must have keen men and women in their employ to answer inquiries and to "follow through" with salesmen and dealers. Add to this the many thousands of business houses who do no advertising in magazines or newspapers, but use "direct advertising" to a great extent, and make letters a large part of their program, and it will be seen that the field is so large as to be practically without limit.

This course offers a great opportunity for stenographers and other office workers who desire to climb higher up the ladder of success.

Topics Covered in This Course:

BETTER LETTERS (Co-25)—Importance of business letters. Use of words. Acquiring a vocabulary. Parts of speech. Types of sentences. Principles of thinking. Punctuation.

Mechanical Aspects—Arrangement. Style. Correct formulation. Indention. Spacing. Paper as an expression of individuality. Letterhead size and design. Conventional forms. Neatness. The business envelope.

Building the Letter—Unity in thought and presentation. How to secure unity and coherence. Arrangement of letter. Rules for correct formulation. Correctness in form, expression and fact. Clearness. Conciseness versus brevity. Completeness. Especial importance of courtesy.

Sales Letters—Strength and weakness of sales letters. Principles of salesmanship. Elements. Methods of approach. How to secure interest. Reader's viewpoint. Significance of "you." Steps in building letter. Illustrative letters. Classes of letters. Follow-up letters. Testing letters. Letter campaigns. Compiling and testing mailing lists. Form letters and paragraphs. Filing. Reports.

Adjustment Letters—How to make complaints. Adjusting complaints. "You and I" spirit. Suggesting a remedy. Illustrative adjustment letters.

Credit Letters—Securing information. Co-operation of credit with sales department. Handling trade acceptances. Withholding shipments. Refusing credits.

Collection Letters—Keeping customers on good terms. "You and I" spirit. Policy of service. Classes of customers. Meeting conditions. Using courtesy. Good humored appeals. Showing good will. Dignified reminders. Post office rules affecting letters.

Letters of Inquiry. Asking favors. Remittances. Letters of application. Internal letters. To salesmen. Do's and Don't's.

Show-Card Writing

(Dr-27x)

Show-card writing affords an attractive opportunity for the young man of merchandising turn who has a liking for lettering. The work brings a good salary with the larger merchants, and also an excellent opportunity for the man who prefers to open his own studio and serve a number of clients.

One does not have to be skillful in free-hand drawing to succeed as a show-card writer, though, naturally, artistic ability is useful. What is most desirable is a command of a number of good alphabets that can be executed with reasonable speed. Anyone of ordinary intelligence can learn to letter acceptably if he applies himself faithfully for a few months.

Topics Covered in This Course:

SHOW-CARD WRITING (Dr-5)—**Essentials of Show-Card Writing**—The field. Preliminary practice problems. Uses of pencil and pen. Practice exercises. Brush exercises. Study and analysis of letters. Alphabets. Styles of lettering. Principles of color and color combinations. Essentials of ornament. Practical application. Layouts. Arrangement and harmony. Balance. Contrast. Artistic design.

Materials—Pens. Brushes. Proper use. Care of art materials. Shop equipment. Inks. Water and coach colors. Mixing colors. Stencils. Devices.

Price-Cards and Show-Cards—Kinds most applicable for different types of concerns. Clothing. Men's furnishings. Women's furnishings. Department store. Shoe store. Hat store. Cigar store. Candy store. Essentials of good taste. Plain and ornamented cards. Practical problems.

Advanced Applications—Sale show-cards and transparent paper signs. Exhibition work. Illustrated cards. Theatre displays. Lobby display work. Outside displays. Planning. Construction. Practical problems. Posters.

Lettering for Reproduction—Charts. Graphs. Maps. Posters. Photographs. Lantern slide lettering. Film titles. Methods of reproduction. Small and large quantity reproduction.

Show-Card Writing and Store Display

(Ad-4x)

The capable show-card writer has a dependable profession, but his opportunities are largely increased by a good knowledge of store display.

"Show your goods attractively" is a rule of successful merchandising. The importance of effective display is now realized by successful merchants. Every store of worth needs the display man's services, and larger stores employ a force of men. Competition among merchants in their displays is keen. Consequently, the display man of unusual ability has great opportunities.

This course was planned to aid small stores in competing with large city stores by increasing the attractiveness of their show windows, store interiors and merchandise. It is based on the most modern texts and the student's instruction is handled in New York City where his instructors observe and pass on to him the latest ideas of metropolitan merchants.

Subjects Covered in This Course:

SHOW-CARD WRITING (Dr-5)—**Essentials of Show-Card Writing**—The field. Preliminary practice problems. Uses of pencil and pen. Practice exercises. Brush exercises. Study and analysis of letters. Alphabets. Styles of lettering. Principles of color and color combinations. Essentials of ornament. Practical application. Layouts. Arrangement and harmony. Balance. Contrast. Artistic design.

Materials—Pens. Brushes. Proper use. Care of art materials. Shop equipment. Inks. Water and coach colors. Mixing colors. Stencils. Devices.

Price-Cards and Show-Cards—Kinds most applicable for different types of concerns. Clothing. Men's furnishings. Women's furnishings. Department store. Shoe store. Hat store. Cigar store. Candy store. Essentials of good taste. Plain and ornamented cards. Practical problems.

Advanced Applications—Sale show-cards and transparent paper signs. Exhibition work. Illustrated cards. Theatre displays. Lobby display work. Outside displays. Planning. Construction. Practical problems. Posters.

Lettering for Reproduction—Charts. Graphs. Maps. Posters. Photographs. Lantern slide lettering. Film titles. Methods of reproduction. Small and large quantity reproduction.

STORE DISPLAY (Ad-3)—**Principles of Correct Display**—Essentials of arrangement. Value of simplicity. Proper utilization of actual goods. Symmetrical arrangement. Harmony. Striking effects by use of contrast. Adapting display to character of article. Graphic displays. Displays for closely related articles. Displaying a variety of miscellaneous goods. Department stores. General stores. Specialty stores. Adapting displays to large and small windows. Other suggestions.

Materials and Construction—Proper fixtures. Display forms. Figures. Background and window floors. Additional materials and how to use them. Special decorative displays. Kinds of lights and lighting. Getting effective illumination. Displayers.



NO study dates further back or is richer in history than the law. In fact, civilization itself rests on law. If a man were living apart from every other human being he might get along without law, except the law of God. But relationships with other human beings and the complex fabric of civilization create the need, not only for municipal, state, and Federal laws, but law between the nations of the world, known as "international law."

The advance of civilization has broadened the study and practice of law. A century ago the term "corporation lawyer" would have been almost meaningless. Today, corporation or business practice has become a specialty. So has patent practice. The lawyer specializing on estate administration, or the collection of accounts, has become a familiar figure.

There are many other specialties—mining; maritime; goodwill, trademarks, and unfair competition; pensions, etc. Even the courts specialize, as is evidenced today by such departments as those dealing with juveniles and domestic relations.

Not only has the law greatly broadened as a profession, but various groups of business men have seen that a knowledge of the law that relates to their particular work is essential in order that they may act prudently. Real estate men, credit men, sales managers, insurance men, accountants, bookkeepers, secretaries, treasurers, stenographers, advertising men, and men in dozens of other groups need a fair knowledge of the general law, or a thorough knowledge of some specialty in order to perform their duties efficiently. Consequently the study of law is being taken up by an increasing number of men besides those who wish to be professional attorneys. Today it is evidence of a man's foresight if he has fortified his other education with legal knowledge.

Instruction in Law

The head of the Law Department, G. W. Ray, Jr., LL.B., M.A., is particularly well fitted for the position he holds. He is thoroughly versed in all the modern practices of the law. Assisting Mr. Ray in the instruction work are able teachers, who are fully prepared by experience and study to give the student a thorough knowledge of the Law that will prove of value.

Business Law

(Co-10x)

No one has a good business education if he lacks a reasonable knowledge of business law. Daily, sometimes almost every hour of the day, the man of business engages in transactions, or performs some act that should be undertaken only by a person with legal knowledge.

When we make out or receive a check, endorse or deposit one, we have need for certain legal knowledge. The most simple letter may mean undertaking a contract. A thoughtless word or act may mean libel. Thousands of accounts are left unprotected because someone lacks knowledge of the laws that surround sales, credits, and collections.

The man who has studied Business Law as taught in this course will be prepared to master the every-day legal problems that might otherwise destroy his chances for success.

Topics Covered in This Course:

BUSINESS LAW (Co-1)—Formation of contracts. Agreement. Competent parties. Operation and discharge of contracts. Assignment of contracts. Discharge in bankruptcy.

Particular Contracts Concerning Goods—Sales of goods. Duties of seller. Duties of buyer. Bailment of goods. Common carriers of goods. Insurance contracts.

Particular Contracts Concerning Credits—Credits and loans. Contract of guaranty. Kinds of negotiable instruments. Maker's and acceptor's contract. Drawer's and indorser's contract.

Conduct of Business Through Representative—Principal and agent. Obligations of principal and agent to each other. Liability of

principal and agent to third parties. Master and servant.

Business Associations—Forms of conducting business. Partnerships. Joint stock companies. Corporations. Definitions and classification. Organization and powers. Rights and liabilities of stockholders.

Property in Land and Movables—Estates in real property. Land. Relative rights of adjoining owners. Mortgages and liens. Landlord and tenant. Personal property. Kinds and estates. Acquisition and transfer.

Elementary Law

(La-1x)

There are many men who feel the need of more knowledge of law than is contained in a good business law course. They do not expect to undertake the practice of law, but they want the broad grounding that comes from a knowledge of law in general. Such knowledge becomes of great value to the man who rises to an executive position.

The United Y.M.C.A. Schools, therefore, have arranged a separate course that is an ideal combination of business law, including all that the Business Law Course contains, and a very compact and well rounded review of the more general law.

This course gives the student an excellent grounding in civil government, an understanding of the different kinds of laws, and a knowledge of legal rights in general. It goes into criminal law, domestic relations, the laws governing real and personal property, legal procedure, contracts, torts, etc. As will be seen by the synopsis, the list of topics is very comprehensive for a brief course.

Subjects Covered in This Course:

BUSINESS LAW (Co-1)—Preliminary topics. Principles of the contract. Operation and discharge of contracts. Particular contracts. Sales of goods. Bailments. Insurance. Credits and loans. Negotiable instruments. Principal and agent. Partnerships. Corporations. Real property. Personal property.

ELEMENTARY LAW (La-1)—Political powers. Sovereignty. Classification of rights, powers, duties, privileges and conduct in regard thereto. Different kinds of law. Law of persons and things. Corporations. Property. Conduct. Evidence. Pleading. Torts. Contracts. Crimes (in a general rather than a technical way).

Complete Law

(La-2x)

To the man of good mentality, law as a profession is often most attractive, because the position of the lawyer in the community is prominent. His profession brings him into contact with affairs of all kinds and men of all groups, up to the most eminent.

The study of law, in the first place, is a mental developer. Law is based on order, justice and reason. It calls for research, for analysis, for reasoning. The successful student of law becomes a student of habit. He soon learns to delight in delving deeply into the most fundamental principles of whatever subject he investigates. Instead of jumping to conclusions, he forms the habit of looking for facts and of reasoning things out to safe conclusions. As a result, the good lawyer is a man of balance, a conservative, a man who reflects and plans his procedure.

A large proportion of the men within the walls of Congress and the State Legislatures have been lawyers; also most of the Presidents of the United States. It is the usual thing to find an attorney as an executive of a large business organization. His services are in constant use in order that the deliberations and acts of the organization may be on a safe basis.

A young man could hardly have a firmer foundation for success than a good knowledge of law, whether or not he ever practices in the courts.

This course covers the entire field of law as shown by the synopsis below. This knowledge is necessary for successful practice as a consulting attorney or trial lawyer, no matter in which state the student may locate. Upon completion of these studies he should have no difficulty in passing all examinations in these subjects.

"Every man who expects to achieve substantial success in the business or professional world should be legally trained."—Ex-President William H. Taft

Subjects Covered in This Course:

BUSINESS LAW (Co-1)—Preliminary topics. Principles of contract. Operation and discharge of contracts. Particular contracts. Sales of goods. Bailments. Insurance. Credits and loans. Negotiable instruments. Principal and agent. Partnerships. Corporations. Real property. Personal property.

ELEMENTARY LAW (La-1)—Political powers. Sovereignty. Classification of rights, powers, duties, privileges and conduct in regard thereto. Different kinds of law. Law of persons and things. Corporations. Property. Conduct. Evidence. Pleading. Torts. Contracts. Crimes (in a general rather than a technical way).

CONTRACTS (La-2)—General principles of contract law. Formation, operation, and discharge of contracts. Damages for breach thereof. Foundation for study of special application of contract law—in agency, partnership, bailments, negotiable instruments, etc., which are dealt with in other lessons.

CRIMINAL LAW (La-3)—Comprehensive view of criminal law, common and statutory. Its historic and political bearings.

TORTS (La-6)—Fundamental differences between trespass and case. Legal cause. Legal damage. Assault. Battery. Conversions. Deceit. Defamation. Injuries caused by negligence. Malicious prosecution. Examination of the increasing numbers of instances of absolute liability.

COMMON LAW PLEADING (La-20)—Relationship between substantive law and procedure from the common law point of view, including a thorough examination of the forms of action at common law and the principles of common law pleading.

PROPERTY I (La-5)—Possession. Methods of acquiring title to chattels. Liens and pledges. Conversion. Tenure of real property. Estate of tenancies. Reversions and remainders. Common law methods of creating and transferring estates. Statute of uses. Rights incident to ownership of estate inland. Fixtures. Waste. Profits. Easements. Licenses. Covenants running with the land.

PERSONS AND DOMESTIC RELATIONS (La-7)—Marriage. Dissolution of marriage. Rights of husband and wife. Infancy. Parent and child. Guardian and ward. Powers and obligations of guardians. Master and servant. Employer's liability by common law and by status.

EQUITY AND TRUSTS (La-8)—Nature and underlying principles of equity, their growth and development, including a discussion of equitable remedies. Nature of a trust. Its creation. Relationship and duties of cestui and trustee.

AGENCY (La-9)—Requisites for creation. Principal's liability for torts of the agent. Responsibility of the agent to third persons. Undisclosed principal. Duties of principal and agent. Delegation of powers by the agent. Ratification. Termination of agency.

PARTNERSHIP (La-10)—Creation of a partnership. Its nature and characteristics. Its duration. Powers of partners. Their rights and duties inter se. Their remedies inter se. Rights and remedies of creditors. Termination of the relation. Limited partnerships.

PROPERTY II (La-12)—Full treatment of the principles of the law of real property. Rights in another's land. Accretion. Adversive possession. Prescription. Conveyancing. Estoppel by deed. Dedication.

SALES (La-13)—Subject matter of sale of personal property. Passing of title. Use of documents of sale. Shipments. Fraud. Rights and remedies of seller and purchaser.

SURETYSHIP (La-21)—Kinds of suretyship. Nature of the contract. Relation of the Statute of Frauds to suretyship agreements. Surety's defenses. Subrogation. Exoneration.

CORPORATIONS (La-17)—General principles of corporations, law, including the corporation's relations with the State, its promoters, its stockholders, and its creditors. Selected text and case books.

MORTGAGES (La-22)—Theories as to mortgages. Common law as compared with lien theory. Equitable mortgages. Rights and liabilities of mortgagor, mortgagee, assignees and other parties in interest. Priority of liens. Subrogation and exoneration. Marshalling. Forms of mortgages.

PROPERTY III (La-16)—Conditional estates. Future interests. Reversions and remainder. Future uses. Executory devises. Determination of classes. Powers. The rule against perpetuities. Selected text and case books.

CONSTITUTIONAL LAW (La-14)—Legislative, executive and judicial powers. Relation of Nation and States. The commerce clause. Due process of law. Other topics.

CONFLICT OF LAWS (La-15)—Jurisdiction of law over persons and things, of courts, in rem, in personam, quasi in rem, and for divorce. Creation and enforcement of foreign rights. Remedies. Particular classes of rights. Administration of estates.

EVIDENCE (La-11)—Judicial notice. Burden of proof and presumptions. Admissions and confessions. Character. Opinion evidence. The hearsay rule and its exceptions. Privileges and disqualifications of witnesses. Examination of witnesses.

***TRIAL PRACTICE** (La-23)—Pleadings and procedure in the trial of cases. Process of summoning to trial. Means of bringing suit in law and in equity. Necessary papers in various actions. Process of appeal. Extraordinary remedies. Courts and jurisdiction.

***CODE PLEADING** (La-24) — Modes and means of trying cases. Various forms of action. Joinder of parties, and declaratory judgments in the code states. Papers necessary in practice and pleading.

* *One of these subjects is required. The selection is governed by the locality in which the student lives.*

Finds Course Ready Reference on Legal Questions

Your Business Law course is valuable to the layman. With this knowledge, consultation with a lawyer is often unnecessary, and when such advice is necessary the legal points are more readily understandable.

I am pleased with the course primarily for the value it is to me; not only for the things one remembers from a study of the course, but the ready reference the text and returned lessons afford. One may, in a few moments, with this information at hand, look up legal questions and feel sure of his ground. —S. E. McELWAIN, Huntingdon, Pa.

TRAFFIC MANAGEMENT

IF you want to get into a profession that you can enjoy as your life work where the opportunities for advancement and large salaries are limited only by ability and experience—study Traffic Management.

Even though traffic management is still young as a profession, its great importance to the successful operation of business has created an ever-increasing demand for trained men that far exceeds the supply. Few fields of work offer better chances for progress.

Over half a million going business concerns in this country need the services of the trained traffic man who knows how to cut down the losses of time and money in the shipping and receiving of goods. Thousands of traffic men are employed in the pleasant, congenial, good-paying work of directing the traffic over the 260,000 miles of railroad in this country. Thousands of large concerns and many more smaller concerns have desks waiting for consulting traffic managers who can save them time and money through the application of technical traffic knowledge.

Now is a good time for you to go ahead of the other fellow by getting into this profession while it is still in the process of development. Getting in on the ground floor when there is plenty of room, and growing with your work, is the sure way to success.

The past ten years have seen traffic work develop from an inferior tool in the operation of business to a profession of importance. Business concerns over the country have awakened to the realization that they must have men in charge of their shipping and receiving who have a broad knowledge of traffic work. The increase in production efficiency has only served to increase this demand. Such positions are not small confined jobs, but are real jobs for he-men with brains and ambition.

Builders of the Traffic Management Courses

The active head of the Traffic Management Department, and author of these courses, Mr. Charles F. Walden, is a practical traffic man of broad experience which covers a period of over 30 years. He was actively engaged in the Freight Traffic Department of the Pennsylvania Railroad for years, and subsequently as President of one of New York City's largest freight forwarding companies. In addition to his own understanding of transportation Mr. Walden has drawn upon the knowledge and experience of a number of America's foremost traffic managers in building the text books and special reading assignments which accompany the lessons. The names of these men with their positions in the business world are listed below:



CHARLES F. WALDEN

F. T. Bentley, *Traffic Manager, Illinois Steel Corporation.*

J. H. Butler, *General Manager, Loss and Damage Dept., American Railway Express Company.*

T. T. Harkrader, *Traffic Manager, American Tobacco Co.*

C. L. Hilleary, *Traffic Manager, F. W. Woolworth Company.*

B. Olney Hough, *Editor, The American Exporter.*

R. J. Menzies, *General Traffic Manager, International Nickel Company.*

Wm. Simmons, *General Freight and Passenger Agent, Southern Pacific Company.*

G. Burt Zimmerman, *Secretary and General Manager, Columbia Refining Company.*

Transportation

(TM-1x)

Every man engaged in the shipping or receiving of freight should understand the fundamentals of transportation and how a traffic department is organized for greatest efficiency. To accomplish this he must be familiar with all the agencies of transportation, the method by which it is regulated, the documents required, the various kinds of cars and the actual movement of freight. He should know the rules of the Consolidated Classification and also the rules governing demurrage and storage, lighterage and switching, diversion and reconsignment.

This course gives instruction in all the fundamental principles governing transportation, preparing the student to become a competent shipping man.

Topics Covered in This Course:

FUNDAMENTALS OF TRANSPORTATION (TM-1). Organized traffic department. Development of transportation and its regulation. Modern transportation agencies. Shipping papers. Freight cars. Weights and weighing. Actual movement of freight, both inbound and outbound. Shipping and receiving departments. Routing. Demurrage and storage. Lighterage and switching. Diversion and reconsignment. Freight classification. Interpretation of classification rules.

Tariffs and Rates

(TM-2x)

A knowledge of tariffs and the method of determining rates is necessary in the operation of a traffic department. The Tariff is the "price list" of transportation. The charges applicable to a given movement are stated in a clear, concise way. There is no better way to learn the correct interpretation of tariffs than by working out the actual problems in these lessons.

This course instructs the student in classifications and actual tariffs and how to interpret them. It enables the student to understand tariff construction so that he may apply his knowledge in a workable manner.

Topics Covered in This Course:

TARIFF INTERPRETATION AND RATE CONSTRUCTION (TM-2). Tariff construction. Rate factors. Rate construction. Determination of rates applicable. Differentials and combination rates. Proportional rates. Local tariff and exception sheet. Local, joint, proportional, class and commodity tariffs. Selecting tariffs applicable, and determining rates.

Claims and Transportation Law

(TM-3x)

Next to the traffic manager, the most important man in a traffic department is the assistant in charge of claims. To handle this work requires an intelligent understanding of transportation and a technical knowledge of rates and all the elements that enter into the movement of freight. He must know all about the express and parcel post service, understand transportation law, and be qualified to appear before the Interstate Commerce Commission and present a reparation claim in the correct manner.

Topics Covered in This Course:

EXPRESS AND PARCEL POST: CLAIMS AND TRANSPORTATION LAW (TM-3). Overcharge. Loss and damage claims. Value of express service. Express classification. Rates. Claims. Character and value of parcel post service. Law of carriers of goods. Interstate Commerce Act. Interstate Commerce Commission rulings. Rules of practice before the Interstate Commerce Commission.

Cannot Reckon the Benefit of His Course in Dollars

Enclosed is $10.00, this month's payment. It is a pleasure to send this The returns I get never could be bought for so little. I could not reckon the benefit in dollars.

—GEORGE BREKUS, Caldwell, N. J.

Your Ship May Not Come in Unless You Have Sent One Out

Ocean Transportation

(TM-4x)

The great war opened up the markets of the world to America's products. The countless industrial concerns, as well as the exclusively import and export houses engaged in foreign trade, must have men thoroughly experienced in ocean transportation. These positions, due to their importance, pay high salaries and offer many opportunities for growth. The knowledge of ocean traffic is confined to so few men that the demand for import and export traffic men far exceeds the supply.

This course gives the complete understanding of the subject that insures success in a new field, as yet practically untouched.

Topics Covered in This Course:

OCEAN TRANSPORTATION (TM-4). The Export Traffic Manager, qualifications and duties. United States Shipping Act. Steamship lines and routes. Preparing shipments. Packing and marking export shipments. Engaging ocean freight room. Shipping papers. Export rates from points in the United States. Ocean freight rates. Marine insurance. Customs house clearance. Trucking. Lighterage. Storage at seaports. Export and steamship bills of lading. Shipments by rail from interior points. Combination shipments by foreign freight forwarders. Organization and operation. Import freight. Foreign express service and parcel post.

Domestic Traffic Management

(TM-5x)

To supply one hundred and ten million people with needful products depends entirely on transportation facilities. Hundreds of thousands of business concerns throughout the country require the services of men trained in Domestic Traffic to handle efficiently the problems of their shipping and receiving.

Domestic Traffic is well taught in the course, giving the student the practical knowledge of the subject that will prove the foundation of success.

Subjects Covered in This Course:

FUNDAMENTALS OF TRANSPORTATION (TM-1). Organized traffic department. Development of transportation. Modern transportation. Shipping papers. Freight cars. Actual movement of freight. Shipping and receiving departments. Routing. Demurrage and storage. Lighterage and switching. Diversion and reconsignment. Freight classifications. Interpretation of classification rules.

TARIFF INTERPRETATION AND RATE CONSTRUCTION (TM-2). Tariff construction. Rate factors. Rate construction. Determination of rates applicable. Differentials and combination rates. Proportional rates. Local tariffs and exception sheets.

EXPRESS AND PARCEL POST: CLAIMS AND TRANSPORTATION LAW (TM-3). Overcharge. Loss and damage claims. Value of express service. Express classification. Rates. Claims. Parcel post service. Law of carriers of goods. Interstate Commerce Act. Interstate Commerce Commission rulings. Rules of practice before the Interstate Commerce Commission.

Complete Traffic Management

(TM-6x)

The young man anxious to find an interesting, congenial profession that will offer him advancement and an opportunity to earn a good income, should study Traffic Management. Shipping clerks, rate clerks, and other men in traffic departments will progress faster if they learn Traffic Management.

This course teaches every phase of both domestic and ocean traffic work. The textbooks used are up-to-the-minute in every detail. The student is taught in a practical way how to solve problems that daily confront the average traffic man.

Subjects Covered in This Course:

FUNDAMENTALS OF TRANSPORTATION (TM-1). Organized traffic department. Development of transportation. Modern transportation. Shipping papers. Freight cars. Actual movement of freight. Shipping and receiving departments. Routing. Demurrage and storage. Lighterage and switching. Diversion and reconsignment. Freight classification. Interpretation of classification rules.

TARIFF INTERPRETATION AND RATE CONSTRUCTION (TM-2). Tariff construction. Rate factors. Rate construction. Determination of rates applicable. Differentials and combination rates. Proportional rates. Local tariff and exception sheets. Local, joint, proportional, class and commodity tariffs. Selecting tariffs applicable.

EXPRESS AND PARCEL POST—CLAIMS AND TRANSPORTATION LAW (TM-3). Overcharge. Loss and damage claims. Value of express service. Express classification. Rates. Claims. Parcel post service. Law of carriers of goods. Interstate Commerce Act. Interstate Commerce Commission rulings. Rules of practice before the I.C.C.

OCEAN TRANSPORTATION (TM-4). Export traffic manager. United States Shipping Act. Steamship lines and rates. Preparing shipments. Packing and marking export shipments. Engaging ocean freight room. Shipping papers. Export rates. Ocean freight rates. Marine insurance. Customs house clearance. Foreign freight forwarders. Import freight. Foreign express service and parcel post.

"Every Great Mercantile House Must Have a Traffic Manager"

In giving his views on Traffic Management in a recent letter to the United Y.M.C.A. Schools, John Wanamaker, America's great merchant, says the following:

EVERY great mercantile business, especially every great distributing house, must have as its traffic manager a well trained man of good common sense and quick, accurate judgment.

"Traffic management is one of the few uncrowded fields of business and one of the least understood by both business men and the general public. It is the traffic manager's business to protect his firm from improper shipping methods, which are subject to a heavy fine under the Interstate Commerce Commission rulings.

"It is his business to have goods moved by the quickest and cheapest route, to be thoroughly acquainted with packing and shipping requirements and to be able to classify all kinds of merchandise; to secure the lowest rate to any point in the United States or foreign countries.

"He should know the rates of exchange; how to get in touch with any foreign steamship line; how to file claims for damage with all supporting legal papers; how to have commodity rates established; how to resist excessive rates; and to bear himself so courteously in business as to secure the friendly co-operation of transportation officials.

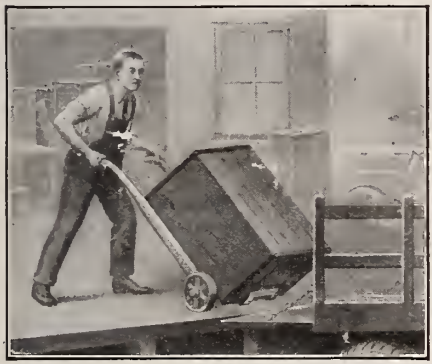
"The old-time, untrained shipping clerk was often a very costly servant to the business. Nowadays the trained and intelligent traffic manager is one of the most important factors in the economic conduct of any large commercial establishment."

John Wanamaker



WHEN OPPORTUNITY COMES BE READY

The broad knowledge of Traffic Management gained through Y.M.C.A. Courses, coupled with practical experience in handling shipping details is bringing many young men success in this uncrowded field.



LET YOUR VISION REACH FURTHER THAN PAY DAY

Prepare for the job ahead by studying Traffic Management



COMMERCIAL ART STUDENTS' LESSONS
Show Fine Pen, Pencil, and Color Technique

COMMERCIAL ART

ART as an important factor in the commercial world, is clearly shown by the large sums that are paid to first-class artists for their work. Advertising agencies, publishing houses, publicity organizations, manufacturers, wholesalers and retailers are utilizing the power of pictures in their advertising and illustrating. Some of these organizations carry permanent staffs of artists, while others depend on the free-lance artist.

A competent artist employed by a commercial concern receives $50 to $100 a week and more. Then, with the improvement in his creative ability and working finesse, his pay increases accordingly. The independent artist receives a good income from his work, and in this wide-open field he can follow largely his own inclinations in illustrating.

Coles Phillips, whose work has been such a selling power for Community Silver; Edw. V. Brewer, whose paintings for Cream of Wheat have brought happy smiles to the faces of a million readers; Maxfield Parrish, whose imaginative poster creations for The Edison Laboratories have excited favorable comment and admiration; and hundreds of others equally as well known, have incomes that are up in the thousands.

These artists at one time knew nothing about their present profession. They had to learn just as you are going to do. Your opportunities to rise in this profession as high as some of these men are limited only by your own ability—it rests entirely with you whether you remain one of the "also rans" or advance to a foremost position as an artist.

Art technique as taught by correspondence through the United Y.M.C.A. Schools will give you the thorough, practical training that will prepare you to enter this field. Then as experience gives you a broader knowledge of art and its applications and develops your talent, your ability to apply your individuality will open new avenues of expression that should bring increased opportunities for success.

Some of the most prominent artists, illustrators and cartoonists are helping to make these art courses most practical. The student receives the benefit of their technical knowledge, gained only by years of study and experience.

The Instructors

Mr. Frank R. Southard is in charge of the course. He has studied under William Chase, Thomas Fogarty, John Carlson, Edward Dufner, F. Louis Mora and others at the Art Students' League of New York, the Woodstock School of Landscape Painting, Cooper Union, Pratt Institute and has spent many months studying in Europe on travel tours. Mr. Southard has had over fifteen years of experience in newspaper work on New York dailies, department store advertising experience and catalog work, illustrating works of fiction, text-books and magazines, developing and selling ideas to some of the great industrial institutions of the country.



FRANK R. SOUTHARD

One of the able instructors assisting Mr. Southard is Eugene M. Frandzen, who has studied at the Academy of Fine Arts and the Art Institute of Chicago, and the Art Students' League of New York. His experience in the field of art has been broad. He has spent several successful years in advertising and newspaper illustrating, and is exceptionally well qualified to teach these subjects.

Natural Talents Developed by Unique Instruction

The individual native ability of each student is developed to the highest degree of perfection by our unique method of instruction. As the student progresses in the course his work is watched carefully to ascertain along which line his talent is developing. He is advised as to his ability in that line, which might be magazine illustrating or cartooning, for example, and if his interest is in that branch of art, he is given special instruction and the most practical help to aid him in realizing his ambition. Our aim is to adapt Y.M.C.A. Correspondence Courses to the desires and abilities of students so far as possible, rather than require them to follow rigid methods and fixed orders of study.

Book and Magazine Illustrating

Every year the presses of the country are kept humming, turning out more and more books. Most of them are illustrated, especially the works of fiction. For those who have the ability to draw, this is an interesting and fascinating field. The publishers have raised the standards of illustrating to so high a degree that an artist must have a thorough knowledge of the fundamental principles, and then know the special requirements for this work.

The success that has been achieved in this field by Thomas Fogarty, N. C. Wyeth, W. T. Benda, C. E. Chambers and hundreds of other well known illustrators, is open to every young person of ability who is willing to work.

Cover Designing

Every book, magazine and catalog needs a cover design. It is the front door to the contents within. Much thought, time, and expense are used to make it as attractive as possible. For the beginner who has a feeling for design, decoration and lettering, Cover Designing will be intensely interesting. For one already busy at drawing this may be an opportunity to try his hand at something new, or possibly a chance to enter a more remunerative field.

Neysa McMien, whose beautiful, youthful girls that you see on the cover of the Saturday Evening Post, McClure's and other magazines; Norman Rockwell; Harrison Fisher, whose ideal well-known poster girl appears each month on the Cosmopolitan cover; Montgomery Flagg; and a host of others are known in a million homes by the designs they have created.

Cartooning and Caricaturing

Great cartoonists make nations laugh, weep, and reform—a wonderful tribute to the power of the mind and ability to use the brush and pen with skill—a power that is a rare gift.

If you feel that you can express in line drawing the more subtle thoughts and opinions of everyday life, you should become a cartoonist. Such topical cartoonists as Jay N. Darling ("Ding"), Cesare, and McCutcheon; and caricaturists such as Bud Fisher with his "Mutt and Jeff," Clare Briggs with his "Days of Real Sport," and McManus with his "Bringing up Father," have exceptionally attractive incomes. They portray a public opinion or emotion so that the reader understands it instantly. They can make us laugh or weep.

It may be that your talent to do little thumb-nail sketches, or to give expression in pictures of your thoughts, and make people smile, may be latent ability which needs but the proper development to make your name known throughout the world. Nowadays it is possible for an artist to do humorous work, sell it to a syndicate and then get it turned into animated motion pictures.

Newspaper Illustrating

The demand is great for men and women who know how to draw for newspapers. Our training will help a beginner to specialize for the peculiar requirements demanded by a newspaper. The work is thorough and comprehensive. Court sketching, fashion drawing, assignment sketches, fiction drawings, pen portraits, layouts and special features comprise the work of a newspaper artist. Often he is called upon to visit the scene of an accident, wreck, prize fight, or murder, where the work requires ability, skill and speed.

Commercial Illustrating

(CA-1x)

Over a thousand periodicals are making use of illustrations. Millions of dollars are spent yearly by advertisers to picture their products, their appliances, and how to use them. Practically every book published has one or more illustrations. As can be seen, there is a great, rich field of opportunity open to the clever illustrator. The scarcity of men and women expert in this work makes illustrating a most attractive profession.

In this course, which was built with the aid of some of the best known illustrators in the country, the student gets a broad, comprehensive knowledge and the practice necessary to give him a good start in practical work.

Topics Covered in This Course:

COMMERCIAL ILLUSTRATING (CA-1)—Beginning to Draw—Basic structure symbols of all drawings. Triangle. Square. Circle. Outline drawing. Black and white silhouettes.

Light and Shade—Point of view. Conventional ray. General methods of casting shadows. Oblique projection. Similarity of shadows and perspective. Three-value method.

Object Drawing—Proportions. Details. Perspective.

Group Story Idea—Objects bearing story relationship to each other. Arrangement composition. Silhouette.

Perspective—Vanishing points. Cone of vision. Linear. Curve-linear. Parallel. Angular. Importance and use.

Pen Drawing—Style. Materials used. Technique and control. Tone. Still life. Value, texture, color. Ambience.

Wash Drawing—Materials used. Colors. Still life and nature sketching. Composition. Importance of tone. Wash drawings. Finished drawings. Contemporary work.

Color—Spectrum. Theory of color. Harmony. Psychology of color. Application. Water colors and oils. Poster colors.

Tempera Drawing.

Lettering—History of lettering. Elements. Plain. Decorative. Ornamental.

Design and Decoration—Theory and practical treatments. Textures and lines. Application of ideas. Border treatments. Headings. Book covers.

Composition—Line. Form. Values. Light. Shade. Arrangement of ideas, objects and groups. Pictorial. Advertisements. Design. Theory and practical application.

Magazine, Book and Fiction Illustrating—Theory. Practical application. Black and white, wash tempered, oils and color. Use of models. Story ideas. Value of style and technique. Method of reproductions.

Illustrations for Advertisements—Mediums. Styles. Methods. Reproductions. Varied forms.

Drawing from Life—Costume, draped figure. Black and white. Color. Pencil. Pen. Brush. Oils, water colors, and wash tempers. Facial expressions. Portraits, oil, pen, and wash. Animal sketching. Retouched photos. Proportions. Anatomy. Life.

Fashion Illustrating—Wash. Line. Color. Use and application.

Cast Drawing—Value of practice. Treatments. Charcoal. Pen and ink. Color. Fixing drawings.

Cover Design—Booklets. Magazines. Blotters. Folders. Cutouts. Posters.

Interiors—Perspective. Layouts. Design. Architectural use of elements. Renderings in pen and ink. Brush colors and oils.

Drawing from Nature—Landscapes. Foreground. Middle distance. Horizon. Planes and uprights. Sky. Day. Night.

Newspaper Work—Drawings from photos. Pen sketches. Crayon. Charcoal. Lithographic pencils. Ross board. Court-room sketches. Accidents. Portraits. News illustrations. Cartoons. Comics. Jokes. Sports. Layouts and designs. Silverprints.

Cartooning and Caricaturing—Classes of cartoons. Caricaturing. Comics and jokes. Pen and ink. Colored newspaper drawings.

Retouching—Air-brush work. Mechanical. Line. Wash. Special treatment. Ross board. Ink. Crayon. Pencil. Benday tints.

Processes of Reproduction—Modern methods. Cuts. Half-tone. Line. Various types. How to prepare a drawing. Marking proper size. Paper. Printing. Copyrighting pictures.

How to Sell a Drawing—Selling by mail. Selling by agents. Personal interviews. Art editors. Managers. Advertising managers. Advertising agencies. Engraving houses.

Art as an Adjunct

Even if one lacks sufficient natural talent to become a professional, highly paid illustrator, the ability to draw is worth a great deal. For instance, if the mechanical draftsman is able to do certain freehand work, can show perspective views and work up other sketches, his usefulness is greatly increased.

The advertising man who is able to lay out a suggested advertisement graphically can secure orders, which otherwise he is not likely to get. The printer who can fix up a dummy of a booklet or catalog by even roughly sketching in illustrations, color treatment, etc., will often find this the most effective way of securing orders and building up a profitable trade.

In the Long Run Trained Heads Win



DRAFTING is one of the most attractive lines of work. The opportunities for growth, which at all times are open to the draftsman with energy and ability, are sufficient to satisfy the demands of the most ambitious. The important place that drafting holds in commerce to-day is illustrated by the fact that nearly everything constructed by the hand of man is first worked out in detail by a draftsman. Every building first comes into definite shape under his trained hand; each detail being figured to the thousandth of an inch. Then the engineers follow these drawings until the last nail is driven and the building completed. The automobile, every piece of machinery, and a hundred and one other articles that are in every-day use, reach the point of perfect construction only after the details have been worked out on a drawing board.

The draftsman from his important place in the business world finds opportunities in many directions. He may rise to a position of construction engineer, designer, contractor or one of the many other professions connected with building. The majority of the most successful construction men, contractors and designers, started their upward climb from the position of draftsman.

You do not have to contend with many of the disagreeable duties of the average worker when employed as a draftsman. As a creator of ideas you are respected. Your work, which is always changing in nature, never becomes monotonous. You are associated with men of importance—architects, promoters of residential districts, manufacturing plant engineers and others who, noting your ability, are likely to offer you opportunities to advance further.

Like all other professional men, draftsmen have to begin at a very moderate salary, between $35 and $50 a week. As soon as you show ability your pay will increase. There are a great many draftsmen earning from $60 to $125 a week. The opportunities for increased income beyond that point depend entirely on your own ability and energy. There is no set limit.

Our methods of teaching do not determine how fast or how slow a student shall complete his studies. That depends entirely upon you. The one main advantage in studying drafting is, that a great deal of preliminary training or education is not as necessary as it is in many other lines of work. You waste no time, but immediately start learning the business of drawing.

Instruction Service

The Head of the Drawing Department is Frederick W. Ming, who was formerly Mechanical Engineer for the Interstate Commerce Commission, Tool Designer for the Mergenthaler Linotype Co.; Tool Designer for the Standard Steel Car Company; Tool Checker for the Wright-Martin Aircraft Corporation; Efficiency Engineer for the Ithaca Gun Company; during the war he was Chief Engineer of the Davenport Manufacturing Company (U. S. plant making 240 mm. howitzers). For several years he has been Instructor of Mechanical Engineering at the Brooklyn Polytechnic Institute. He is also a member of the American Society of Mechanical Engineers and the Society for the Promotion of Engineering Education. Mr. Ming is assisted by fifteen specialists who are experts in their own particular branch of drawing. Every student is given the benefit of the help and advice which the combined experience of these specialists makes possible.



FREDERICK W. MING

Architectural Drawing

(Ar-14x)

A more advanced course in Architectural Drawing, especially designed to give a general training in the elementary mathematics and drawing required by the junior draftsman in an architect's or builder's office, and to train the contractor to make his own drawings and details.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Development of surfaces. Intersection of surfaces. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction which will be necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

ARCHITECTURAL DRAWING (Ar-16)—Sketch plans. Architectural symbols. Stairway circulation. Working drawings of a brick house. Working drawings of a frame house. Floor plans. Elevations. Sections. Scale and full-size details. Analysis of several existing drawings.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications, and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

ELEMENTARY PERSPECTIVE (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan method. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

THE CLASSIC ORDERS (Ar-15)—General proportions. Profile of mouldings. Tuscan order. Doric order. Ionic order. Corinthian order. Comparison of orders. Parapets and balustrades. Doors and windows. Colonades. Arcades. Superposition. Modern applications of the classic orders.

SHADES AND SHADOWS (Ar-14)—Point of view. Conventional ray. Similarity of shadows and perspective. Shadows of circle. Shadows of straight lines. Shades and shadows of spheres. General methods of casting shadows. Oblique projection. Circumscribing surfaces. Auxiliary shadows. Slicing method. Practical applications. Shades and shadows of cones. Shades and shadows of cylinders. Miscellaneous problems. Shades and shadows of the classic orders.

WATER COLOR RENDERING—(Ar-18)—Rendering architectural subjects. Materials used. Method of using materials. Colors. Still life and nature sketching. Elementary problem in monotone. Commencing a water color sketch. Elementary problems in colors. Difficulties encountered. Composition in landscape. Composition applied to architectural subjects. The silhouette. Painting from nature. Difficulties in working from nature. The importance of tone. Foliage in trees. Clouds and skies. Architectural problems. Architectural shades and shadows in monotone. Wash drawings. Finished drawing. Contemporary work.

PEN DRAWING (Ar-17)—Style. Limitations of the pen. Materials used. Technique and control. Tone. Still life. Shadows. Values, texture and color. Preliminary sketch. Elementary composition. Simple renderings. Foliage. Figures. Water and clouds. Practical problems. Architectural drawing. Aerial perspective. Ambience. Criticism of contemporary work.

Elementary Architectural Drawing

(Ar-13x)

This elementary course in Architectural Drawing is planned to enable the student to qualify for advancement by becoming proficient in the use of mathematics and elementary drawing. The knowledge of elementary drawing is an asset to anyone, whether or not he intends to become an architect. It is of value to the carpenter, mason, contractor, or worker in the building trades.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Development of surfaces. Intersection of surfaces. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

By Comparison "Y" Instruction is Best

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ARCHITECTURAL DRAWING (Ar-16)—Sketch plans. Architectural symbols. Stairway circulation. Working drawings of a brick house. Working drawings of a frame house. Floor plans. Elevations. Sections. Scale and full-size details. Analysis of several existing drawings.

***ALGEBRA** (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications, and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

**Optional.* (*See Page* 12.)



LESSON PLATES IN ARCHITECTURAL DRAWING COURSE

Students Quickly Master These Lessons

Architectural Design

(Ar-1x)

To the student who is artistically inclined, this course is recommended. The course is arranged to prepare the student as an architectural draftsman or designer. It is an advanced course, complete in the general subjects of architectural design.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Development of surfaces. Intersection of surfaces. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with Plane Surfaces and Solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

***TRIGONOMETRY** (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

ARCHITECTURAL DRAWING (Ar-16)—Sketch plans. Architectural symbols. Stairway circulation. Working drawings of a brick house. Working drawings of a frame house. Floor plans. Elevations. Sections. Scale and full-size details. Analysis of several existing drawings.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of lines. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

ELEMENTARY PERSPECTIVE (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan method. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

THE CLASSIC ORDERS (Ar-15)—General proportions. Profile of mouldings. Tuscan order. Doric order. Ionic order. Corinthian order. Comparison of orders. Parapets and balustrades. Doors and windows. Colonnades. Arcades. Superposition. Modern applications of the classic orders.

SHADES AND SHADOWS (Ar-14)—Point of view. Conventional ray. Similarity of shadows and perspective. Shadows of circle. Shadows of straight line. Shades and shadows of spheres. General methods of casting shadows. Oblique projection. Circumscribing surfaces. Auxiliary shadows. Slicing method. Practical applications. Shade and shadows of cones. Shade and shadows of cylinders. Miscellaneous problems. Shades and shadows of the classic orders.

HISTORY OF ARCHITECTURE (Ar-1)—Prehistoric. Egyptian. Western Asiatic. Greek. Roman. Early Christian. Byzantine. Romanesque. Gothic. Renaissance. Colonial. American. Non-historic.

ORNAMENT (Ar-19)—Assyrian. Grecian. Roman. Early Christian. Byzantine. Romanesque. Gothic. Renaissance. Non-historic.

ADVANCED PERSPECTIVE (Ar-11)—Planes. Vanishing points of lines. Vanishing points of inclined lines. Various kinds of planes. Vanishing planes. Vertical planes. Ascending planes. Descending planes. Inclined planes. Oblique planes. Shadows. Reflections. General problems.

WATER COLOR RENDERING (Ar-18)—Rendering architectural subjects. Materials used. Methods of using materials. Colors. Still life and nature sketching. Elementary problems in colors. Difficulties encountered. Composition in landscape. Composition applied to architectural subjects. The silhouette. Painting from nature. Difficulties in working from nature. The importance of tone. Foliage and trees. Clouds and skies. Architectural problems. Architectural shades and shadows in monotone. Wash drawings. Finished drawings. Contemporary work.

PEN DRAWING (Ar-17)—Style. Limitations of the pen. Materials used. Technique and control. Tone. Still life. Shadows. Values, texture and color. Preliminary sketch. Elementary composition. Simple renderings. Foliage. Figues. Water and clouds. Practical problems. Architectural drawing. Aerial perspective. Skies. Ambience. Criticism of contemporary work.

HOUSE PLANNING (Ar-20)—Practical problems in planning city and country residences, schools, churches, banks, clubs and the like.

INTERIOR DECORATION (Ar-21)—Form of room. Elevational composition. Doorways, windows, fire-places, stairways and the like. Color. Wood finishing. Details. Hangings. Furnishings. Lighting.

ARCHITECTURAL COMPOSITION (Ar-2)—Standard of taste. What architecture is. Unity. Individuality. Similarity. Subordination. Analysis of buildings. Primary masses. Secondary masses. Details. Horizontal division. Proportion. Contrast. Practical applications. Asymmetrical compositions. Flexibility of types. Comparison and criticism.

**Optional.* (*See Page* 12.)

Structural Drafting

(Dr-22x)

Structural steel engineers generally begin their upward climb by way of the drafting room. The demand for competent structural draftsmen usually exceeds the supply. As a result there are many attractive opportunities for the man who has ambition and the necessary training.

This course covers thoroughly all the information that the structural detailer should have at his command. The student, after completing his course, should be able to execute his work in a way that will attract the favorable attention of those by whom he is employed.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

STRUCTURAL DRAFTING (CE-16)—Shop drawings for structural steel details, bridges and buildings.

General Principles—Definitions. Study methods. Plate layouts. Illustration of beam drawings. Elementary steel shapes and standard connections. Miscellaneous details.

Shop Drawings—Dimensioning beams and channels. Laying out connections, by gusset plates, by lateral plates and by bent plates, with reference to clearance, bevels and edge distances. Drawings for plate girders, roof trusses and columns. Drawings for mill buildings. Drawings for bridge trusses. Checking and correcting drawings.

Billing—Bills of material. Shop bills. Shipping bills. Miscellaneous drawings and lists.

Architectural Rendering

(Ar-17x)

This course is prepared to train anyone in the architectural field who desires to portray his designs by means of freehand pencil drawings, pen-and-ink drawings, or water-color drawings.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

*GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

ELEMENTARY PERSPECTIVE (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan method. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

SHADES AND SHADOWS (Ar-14)—Point of view. Conventional ray. Similarity of shadows and perspective. Shadows of a circle. Shadows of straight lines. Shades and shadows of spheres. General methods of casting shadows. Oblique projection. Circumscribing surfaces. Auxiliary shadows. Slicing method. Practical applications. Shades and shadows of cones. Shades and shadows of

*Optional. (See Page 12.)

cylinders. Miscellaneous problems. Shades and shadows of classic orders.

WATER-COLOR RENDERING (Ar-18)—Rendering architectural subjects. Materials used. Methods of using materials. Colors. Still life and nature sketching. Elementary problem in colors. Commencing a water-color sketch. Elementary prob'em in monotone. Commencing a water-color sketch. Elementary problem in colors. Difficulties encountered. Composition in landscape. Composition applied to architectural subjects. The silhouette. Painting from nature. Difficulties in working from nature. The importance of tone. Foliage and trees. Clouds and skies. Architectural problems. Architectural shades and shadows in monotone. Wash drawings. Finished drawing. Contemporary work.

PEN DRAWING (Ar-17)—Style. Limitations of the pen. Materials used. Technique and control. Tone. Still life. Shadows. Values, texture and color. Preliminary sketch. Elementary composition. Simple renderings. Foliage. Figures. Water and clouds. Practical problems. Architectural drawing. Aerial perspective. Skies. Ambience. Criticism of contemporary work.

Freehand Drawing

(Ar-15x)

An elementary course in Freehand Drawing that will qualify the student to make sketches of still-life objects, buildings, landscapes, and the like. Every person engaged in any kind of architectural or building profession must know how to draw or sketch ideas or objects quickly and accurately.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-22)—Drawing instruments and materials and their uses. Use of lines. Tracing. Geometrical problems. Conic sections—ellipse, parabola, hyperbola.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

***GEOMETRY** (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

ELEMENTARY PERSPECTIVE (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan method. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

Pen Drawing

(Ar-16x)

An elementary course in freehand drawing that teaches the student to make sketches of still-life objects, buildings, landscapes and the like in ink. An especially advantageous course for the architectural student who wishes to render perspectives and other sketches in ink.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-22)—Drawing instruments and materials and their uses. Use of lines. Tracing. Geometrical problems. Conic sections—ellipse, parabola, hyperbola.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

***GEOMETRY** (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

***ELEMENTARY PERSPECTIVE** (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan method. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

PEN DRAWING (Ar-17)—Style. Limitations of the pen. Materials used. Technique and control. Tone. Still life. Shadows. Values, texture and color. Preliminary sketch. Elementary composition. Simple renderings. Foliage. Figures. Water and clouds. Practical problems. Architectural drawing. Aerial perspective. Skies. Ambience. Criticism of contemporary work.

**Optional.* (*See Page* 12.)

Water-Color Rendering

(Ar-11x)

A course designed to provide the student with the training required to render architectural drawings, especially perspective and elevations in color. The study and practice of wash drawings, flat tones, shading and blending are carefully detailed. Practical problems in architectural rendering are entered into, which materially benefit the student.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-22)—Drawing instruments and materials and their uses. Use of lines. Tracings. Geometrical prob'ems. Conic sections—ellipse, parabola, hyperbola.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

***GEOMETRY** (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

***ELEMENTARY PERSPECTIVE** (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan methods. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

WATER-COLOR RENDERING (Ar-18)—Rendering architectural subjects. Materials used. Methods of using materials. Colors. Still life and nature sketching. Elementary problem in monotone. Commencing a water color sketch. Elementary problem in colors. Difficulties encountered. Composition in landscape. Composition applied to architectural subjects. The silhouette. Painting from nature. Difficulties in working from nature. Importance of tone. Foliage and trees. Clouds and skies. Architectural problems. Architectural shades and shadows in monotone. Wash drawings. Finished drawing. Contemporary work.

Sheet Metal Design

(Dr-10x)

A course designed to increase the knowledge of the tinsmith or the sheet-metal worker, qualifying him as a designer of sheet-metal work. The knowledge gained by a study of this course will prepare the student to handle intelligently a wide range of undertakings requiring the use of sheet metal.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Development of surfaces. Intersection of surfaces. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving ariethmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

***TRIGONOMETRY** (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

SHEET METAL DESIGN (Dr-39)—Development by triangulation. Simple patterns. Graphical solutions useful in sheet metal design. Layouts resulting in more complicated patterns. Seams and lap, laying out for duplicate production. Tinsmithing. Skylight work. Roofing. Cornice work.

***FREEHAND DRAWING** (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

***FREEHAND LETTERING** (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

**Optional.* (*See Page* 12.)

Mechanical Drawing, Brief

(Dr-46x)

This course is especially prepared for the student who desires a knowledge of Mechanical Drawing as covered in the first two or three years in high school. Every phase of the subject is gone into thoroughly, giving the student the complete knowledge that will allow him to pass successfully any academic examination in Mechanical Drawing.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

Plan Reading

(Ar-20x)

A course for building mechanics who wish to improve their positions by increasing their knowledge of mathematics and plan reading. The course includes the necessary instruction in arithmetic and geometry, and in a particularly effective way trains the student in plan reading. Several practice problems are included to make the course more interesting and valuable. This course will be of especial benefit to contractors and their employees who need to know how to read drawings.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints and machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans. Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising architect.

Plan Reading with Mathematics

(Ar-18x)

A course for building mechanics who wish to improve their positions by increasing their knowledge of mathematics and plan reading. The course includes the necessary instruction in arithmetic and geometry, and in a particularly effective way trains the student in plan reading. Several practice problems are included to make the course more interesting and valuable. This course will be of especial benefit to contractors and their employees who need the knowledge of reading of drawings.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints and machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans. Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising a chitect.

ARITHME IC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

The world is demanding, as never before, men of good character with well-developed minds. Train your mind and get into the executive class where ability, energy and initiative are justly compensated.

Reading of Heating, Plumbing and Architectural Plans with Mathematics

(Dr-43x)

Every man engaged in architectural construction work should know how to read heating and plumbing plans accurately. He should also know how to make the calculations involved in the actual installation of heating and plumbing systems. This course will provide the student with a thorough knowledge of the subject that can be applied to the humblest house or to the largest office building.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans. Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising architect.

READING OF HEATING AND PLUMBING PLANS (ME-28)—Lessons and blueprints. Heating and plumbing symbols. Heating and plumbing plans for small houses, large houses, apartment houses and office buildings. Student is required to make complete heating and plumbing layouts for an entire building from plans.

Reading of Heating, Plumbing and Architectural Plans

(Dr-42x)

The man employed in the building or allied trades may be able to do his particular job well, but to become proficient in all branches of his work, or to engage in business for himself, he must know how to interpret correctly not only architectural plans, but also plans for heating and plumbing layouts. With the use of actual blueprints the student is given a thorough knowledge of the subject that will help him materially to master the situation.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising architect.

READING OF HEATING AND PLUMBING PLANS—(ME-28)—Lessons and blueprints. Heating and plumbing symbols. Heating and plumbing plans for small houses, large houses, apartment houses and office buildings. Student is required to make complete heating and plumbing layouts for an entire building from plans.

Experienced Draftsman Finds "Y" Course Helpful in His Regular Work

Prior to taking up this course I have had several years' experience in the Drafting Room.

In view of the small amount of work I have completed in the course, my statement could not be very broad, but comparison with parallel work done by a friend of mine shows the well known . . . Courses to be cumbersome and slow, to the point which speaks well for Extension work with the United Y.M.C.A. Schools. I have been able to use the instruction, so far received, in my regular work.

I am well pleased with the course thus far, and if the advanced work is of the same high standard, I shall plan to take up additional studies.

—C. LLOYD FLICK, 923 E. Bowman St., Wooster, Ohio.

Mechanical Drawing

(Dr-13x)

This is an advanced course for the machine detailer. It gives complete and thorough training. It teaches him to detail correctly a wide range of machine parts. It enables him to execute the ideas of the designer in the accurate way that should make his services of much value in the drawing room, and place him in line for early promotion. It also provides elementary training in the problems of design so that he can make the more simple layouts and thus make his services to his employer of still greater value as a designer and also as a checker.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

MACHINE WORKING DRAWING (Dr-46)—Working drawings of complex machine details. Study of dimensioning as related to drawing room, pattern shop and machine shop. Assembly drawings from details. Study of such considerations as scales, proper methods of representation, interference and checking dimensions. Methods of procedure in assembling. Assembly and general shop notes.

DESCRIPTIVE GEOMETRY (Dr-52)—Principles of projection. Manipulation of planes and traces. Practical applications of theory.

Mechanical Drawing with Mathematics, Brief

(Dr-21x)

This is the shortest course which supplies the fundamental training necessary to make you competent to draw machine details and make acceptable tracings. It gives excellent instruction in how to read drawings rapidly and intelligently. The young man who wishes to take up mechanical drafting will find this course a good one with which to start.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

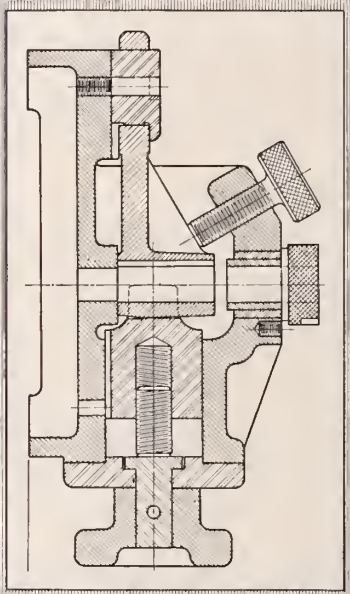
Canadian Student Advances from Clerk to Contractor

I might say that as far as I have gone with the course, it is all and more than I expected, and the information I have gained already I find very beneficial in my new line of business, "Contracting." Since taking up the course I quit my old position, "Clerk," and have started in building houses. I have now completed one and have two under construction, with prospects of building several more when these are completed. I must say that I owe this to the incentive that my course in "Architectural Drawing" has given me.

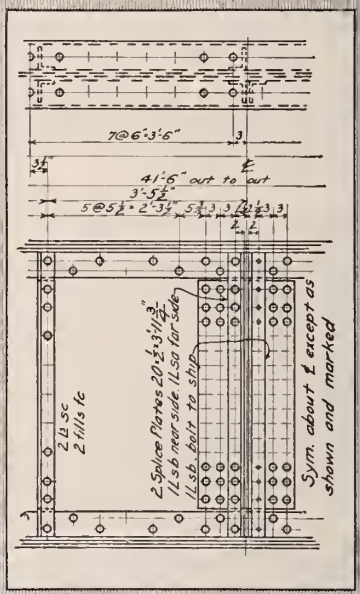
—R. F. HUME, 4523 Second Avenue, W., Vancouver, B.C.

By Comparison "Y" Instruction is Best

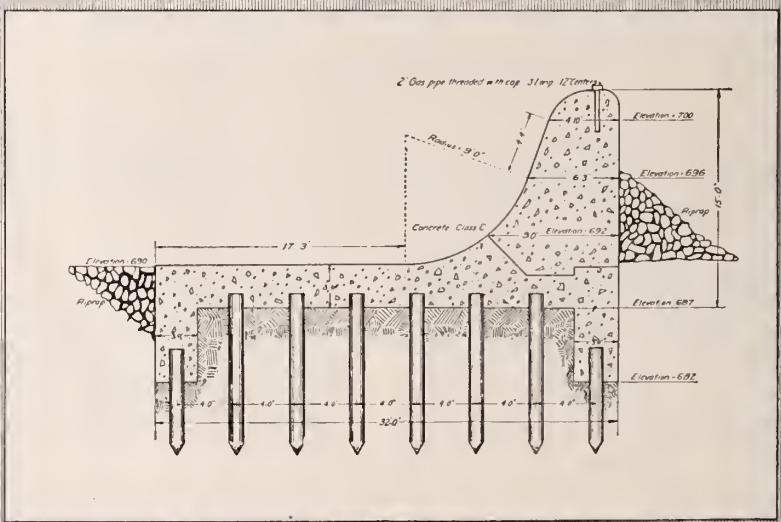
Our students learn to make drawings like these



Section of Drill Jig



Structural Detail



Weir Dam

Machine Drawing and Machine Design

(Dr-16x)

This is an advanced course for engineering students. It is for men who desire to become mechanical designers and acquire not only the ability to detail machinery and make assembly drawings, but perform the calculations and make the layouts required in the designing of machines.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

MACHINE WORKING DRAWING (Dr-46)—Working drawings of complex machine details. Study of dimensioning as related to drawing room, pattern shop and machine shop. Assembly drawings from details. Study of such considerations as scales, proper methods of representations, interference and checking dimensions. Methods of procedure in assembling. Assembly and general shop notes.

DESCRIPTIVE GEOMETRY (Dr-52)—Principles of projections. Manipulation of planes and traces. Practice in the use and making of plates.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

MACHINE DRAWING (Dr-9)—Calculation of detail dimensions from empirical formulas. Limitations of such formulas discussed. Detail and assembly drawings of such parts as screws and bolts, keys and cotters, couplings, pulleys, gears, rivets and riveted joints, screw threads, springs, pipe fittings, bearing boxes, valves, stuffing boxes, pistons, crossheads, connecting rods, engine cranks, eccentrics and straps.

MECHANICS OF MATERIALS (CE-12)—Strength of materials. Deformation. Elastic change of length. Properties of materials of engineering. Beams. Theory of beams. Reaction. Vertical shear. Bending moment. Internal and external forces. Safe loads. Column formulas. Combined stresses. Axial shear. Horizontal shear. Resilience and work. Impact. Fatigue of materials. Torsion of shafts.

MECHANISM (Dr-13)—Fundamental ideas in regard to mechanism. Various methods for applying forces. Various linkages and their design. Application of the principles of mechanisms in actual drawings of levers, flexible connectors, rollers, gears, screws, cams, and links.

MACHINE DESIGN (Dr-8)—Calculations for design of various machine details and complete machine parts. Discussions of the application of empirical and theoretical formulas. Derivation of some of the more important formulas. Detail and assembly drawings in accord with calculations made. Machine fastenings. Bearings. Journals. Cylinders and plates. Springs. Belting and pulleys. Spur gearing. Bevel gearing. Worm gearing. Couplings. Clutches. Rope transmission. Brakes. Complete designs.

Freehand Drawing, Brief

(Dr-39x)

If you are engaged in any kind of architectural or building construction work—in the office or "on the job"—you should know how to sketch ideas or objects quickly and accurately. This course teaches how to make sketches of still-life objects, buildings, landscapes, and the like.

Topics Covered in This Course:

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

Machine Sketching and Drawing for Mechanics

(Dr-9x)

The ability to illustrate some point in a discussion by a sketch, to draw details of needed repairs to a machine, and to sketch an idea for a new machine, is of great value to the mechanic and engineer. Every mechanic in the shop knows that he could advance faster if he could draw and sketch.

A study of this course will enable the ambitious mechanic to sketch machinery or parts of machinery rapidly and clearly. It will also enable him to make the necessary scale drawings from these sketches. Instruction is given in the principles on which all drawings and sketches are based. The student prepares and submits his own drawings and sketches. These are returned to him accompanied by practical and helpful suggestions.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastening. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

MACHINE SKETCHING (Dr-48)—Training in the sketching of machine parts. Sketches of machine details, sections and assemblies. Assembly sketches from machine details.

Drawing and Shop Mathematics for Mechanics

(Dr-11x)

The mechanic desiring to enter an engineering office, the man in charge of a small factory who wishes to increase his ability to supervise, and the student who wants a comprehensive training in drawing before he enters the engineering profession, will find that this course supplies the right instruction.

This course gives the training necessary for you to become thoroughly competent to detail machine parts. It is broad and comprehensive enough to enable you to do the work intelligently and to understand the work of the designer. If you are a mechanic, perhaps you have felt the necessity of being able to read blueprints more rapidly and understandingly. The man who can interpret the ideas of the chief engineer and designer accurately and quickly is always more favorably regarded by his employers.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

MACHINE WORKING DRAWING (Dr.-46)—Working drawings of complex machine details. Study of dimensioning as related to drawing room, pattern shop and machine shop. Assembly drawings from details. Study of such considerations as scales, proper methods of representation, interference and checking dimensions. Methods of procedure in assembling. Assembly and general shop notes.

Tool Drafting and Design

(Dr-17x)

The tremendous growth of the principles of interchangeability and mass production in manufacturing lines has created an unsatisfied demand for men capable of designing the required tools and fixtures.

The fundamental principles are thoroughly developed and may be applied to special problems as they arise. The subject is presented in such a way that the student may select the methods best suited to his particular problem. Fixtures operated by compressed air, as found in the more modern machine shops, are given special attention.

This course is excellent for draftsmen and others in the tool designing departments of manufacturing establishments, and for mechanics and toolmakers wishing such training as a basis for future advancement.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

MACHINE WORKING DRAWING (Dr-46)—Working drawings of complex machine details. Study of dimensioning as related to drawing room, pattern shop and machine shop. Assembly drawings from details. Study of such considerations as scales, proper methods of representation, interference and checking dimensions. Methods of procedure in assembling. Assembly and general shop notes.

MACHINE DRAWING (Dr-51)—Calculation of detail dimensions from empirical formulas. Limitations of such formulas discussed. Detail and assembly drawings of such parts as screws and bolts, keys and cotters, couplings, pulleys, gears, rivets and riveted joints, screw threads, springs, pipe fittings, bearing boxes.

TOOL DRAFTING AND DESIGN (Dr-7)—Standard and special tools. Open drill jigs. Box jigs. Special jigs. Milling fixtures. Turning fixtures. Planning fixtures. Pneumatic fixtures. Practical considerations in regard to detailing emphasized throughout. Designing and making of actual working drawings for the shop.

Punch and Die Drafting and Design

(Dr-18x)

Machine shop workers, and men employed in the drafting room who desire to enter a field of interesting work, will find in this course the instruction they require. It deals with all the important forms and types of dies. The actual designing and drawing of punches and dies serves to give the student the working knowledge and practice that will fit him for a secure position in this highly specialized field.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

MACHINE WORKING DRAWING (Dr-46)—Working drawings of complex machine details. Study of dimensioning as related to drawing room, pattern shop and machine shop. Assembly drawings from details. Study of such considerations as scales, proper methods of representation, interference and checking dimensions. Methods of procedure in assembling. Assembly and general shop notes.

MACHINE DRAWING (Dr-51)—Calculation of detail dimensions from empirical formulas. Limitations of such formulas discussed. Details and assembly drawings of such parts as screws and bolts, keys and cotters, couplings, pulleys, gears, rivets and riveted joints, screw threads, springs, pipe fittings, bearing boxes.

PUNCH AND DIE DRAFTING AND DESIGN (Dr-14)—Fundamental principles. Press tools in general. Blanking dies. Piercing tools. Compound dies for blanking and piercing. Parting tools. Shaving dies. Trimming dies. Drawing dies. Combination dies. Bending and forming tools. Dies for embossing, marking, riveting and swaging. Indexing and transfer dies. Punch and die standards. Methods for hardening dies. Design of punches and dies.

Reading of Machine Drawings and Blueprints with Mathematics

(Dr-8x)

A course for apprentices and mechanics desiring to qualify for better positions by increasing their knowledge of mathematics and their ability to read blueprints. It includes the necessary instruction in mathematics to enable the student to perform the calculations required in shop work, and to understand the principles upon which mechanical drawings are made, followed by the study of shop processes and practice in the reading of blueprints.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

READING OF MACHINE DRAWINGS AND BLUEPRINTS (Dr-50)—Bearings. Cylinderheads. Shafts. Crane hooks. Automobile parts. Complex machine details and assembly drawings of machines. Detailed instruction based on blueprints, which we furnish. The viewpoint of the machine shop is emphasized throughout.

Reading of Machine Drawings and Blueprints

(Dr-23x)

Complete instruction, without mathematics, for apprentices and mechanics who want to learn how to read blueprints quickly and accurately. This course includes instruction covering the principles upon which mechanical drawings are made, followed by the study of shop problems and practice in the reading of blueprints.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

READING OF MACHINE DRAWINGS AND BLUEPRINTS (Dr-50)—Bearings. Cylinderheads. Shafts. Crane hooks. Automobile parts. Complex machine details and assembly drawings of machines. Detailed instruction based on blueprints, which we furnish. The viewpoint of the machine shop is emphasized throughout.

Appreciates Interest Instructors Take in Students

You surely have some of the best instructors that I have ever studied under and I wish things were so I could be there in the school room with them. I can't tell you how much I appreciate the interest the school has taken in me.—THOMAS S. ARMS, Horatio, Arkansas.

Comparison Makes Him a Booster for "Y" School Methods

The more assignments in Mechanical Drawing I receive and the more I see of "Y" School methods the more of a booster I am, for I have examined courses of two other prominent correspondence schools and find your course so much more complete, that really there is no comparison.—FRANK E. FISHER, Kiefer, Oklahoma.

Determination Will Achieve Your Desire

Civil Engineering Drawing

(Dr-15x)

To rise to the position of civil engineer a man must know well the branches of drawing and drafting used in this profession. Therefore, whether he starts carrying chain as a member of a surveying crew, or begins in the office of an engineering company, his progress will be slow unless he soon becomes proficient in civil engineering drawing. The student can get from this excellent course exactly the instruction he needs to make his way rapidly into the ranks of competent engineers.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47) Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—General drafting methods applied to Civil Engineering layouts.

Elements of Structural Drafting—Conventional signs. General drawings. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Beam and rivet details. Foundation plans. Masonry symbols.

Map and Topographical Drawing—Plats of surveys. Highway and railroad maps. Topographical symbols—contours, hachures, conventional signs. City plats.

Level Plats—Profiles. Cross sections.

Reading of Civil Engineering Drawings and Blueprints with Mathematics

(Dr-34x)

The man employed in civil engineering who wishes to know how to interpret drawings and blueprints, and desires the mathematical knowledge necessary to make practical calculations, will get from this course a clear understanding of the subject, and the tests required to make him expert.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by means of views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of material.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

READING OF CIVIL ENGINEERING DRAWINGS AND BLUEPRINTS (CE-23)—Reading of sections and profiles. Reading of architectural drawings, including floor plans, elevations, sections and details. Reading of structural drawings including connections, detail drawings, girders, trusses, bridge and mill building designs. Reading of maps. All necessary drawings and blueprints supplied.

Now Sees Advantages of Using Spare Moments to Gain Education

I am taking your course in Architectural Design. It is my pleasure to express satisfaction and to recommend your extension courses. I am also pleased with the outfit provided.

—H. C. CONRAD, Elizabeth, N. J.

"Y" Instruction Makes It Easier to Succeed

Reading of Civil Engineering Drawings and Blueprints

(Dr-19x)

One of the most important factors in Civil Engineering is the ability to read drawings and blueprints with perfect understanding. Construction work would stop today if no one were able to read blueprints. Every man employed in civil engineering, and those about to enter this profession, will find this course of practical help in shortening the path to the top.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by means of views with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of material.

READING OF CIVIL ENGINEERING DRAWINGS AND BLUEPRINTS (CE-23)—Reading of sections and profiles. Reading of architectural drawings, including floor plans, elevations, sections and details. Reading of structural drawings including connections, detail drawings, girders, trusses, bridge and mill building designs. Reading maps. All necessary drawings and blueprints supplied.

Highway Drafting

(CE-2x)

Learn highway drafting and be in line for continuous employment. Highway drafting is generally done in bad weather or dull seasons by the same men who superintend highway construction and make highway surveys.

The subject not only covers the fundamentals of drafting, but also includes instruction in a variety of work generally done by draftsmen in connection with the preparation of plans. It should be useful to highway surveyors, axmen, chainmen, rodmen and inspectors as an addition to their training. Students who are proficient in any of the initial subjects described below may omit them by passing suitable review examinations.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

HIGHWAY DRAFTING (CE-5)—Preparations of highway plans and estimates.

Maps and Conventional Signs—Preparation of title sheets. Alignment plotting. Plotting of topography. Earthwork plans—reduction of level notes and plotting of cross sections. Plotting of profile and grade line. Computation of vertical curves. Applying the designed cross sections to the existing cross sections. Measurement and computation of excavation and embankment.

Final Plans—Preparation of sheets of standards. Tracing final plans.

From Several Satisfied Ohio Students

Compared with another course that I have taken, it is of very high quality and is thoroughly modern and up-to-date. I have had very good and prompt attention from instruction headquarters in every respect.

I have been treated very kindly and courteously at headquarters. I think the course is the best of its kind that I have ever seen and I was really surprised at the quality of the instruction.

The course has helped me a great deal with my figures and has tended to make me more accurate. I am very much pleased. I do not think there is any country in the world, or any organization that could do as much as this.

Electrical Drawing

(Dr-14x)

The tremendous development of electricity has created a large field of opportunity for the specialist. The electrician who wishes to advance must know electrical drawing. This course is so prepared that it can be adapted to the beginner or the man of practical experience. The machine draftsman will find it valuable. It will increase his knowledge of electrical machinery and electrical wiring diagrams.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from detail.

ELECTRICAL DRAWING (EE-18)—Lesson notes and blueprints supply the instruction and data needed for each drawing.

Motor Drawings—Complete assembly and detail drawings of a standard electric motor. Projections. Dimensions. Standard conventions.

Wiring Plans and Diagrams—Conventional symbols. Typical diagrams used by representative electrical manufacturers, both direct current starters and controllers, and alternating current starters and controllers. Automotive diagrams. Standard symbols for wiring plans. Typical plans.

Reading of Electrical Drawings and Blueprints with Mathematics

(Dr-41x)

Whether you are an assembler, machinist on electrical work, test floor man, wireman, toolmaker, maintenance man, or an electrical contractor, a thorough knowledge of how to read electrical drawings and blueprints, combined with the ability to make the mathematical calculations encountered in your work, will help you materially in climbing to a better job. Every phase of the subject is covered in a most logical manner, insuring the student a broad working knowledge that he can put to profitable use.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

READING OF ELECTRICAL DRAWINGS AND BLUEPRINTS (EE-16)—Typical drawings of a standard motor. Wiring diagrams of typical face plate and drum type manual starters, of contractor and autotransformer type automatic starters, of controllers, of panels, of automotive systems, and of a wireless unit. Symbols for wiring diagrams.

Salesmanship Course Helps Develop a Personality

So far as I have gone with the United Y.M.C.A. Schools course in Salesmanship, I have benefited wonderfully, for it truly teaches one to develop a personality. I certainly would not take a thousand dollars for the spare time I used to study the principles of salesmanship.—LEONARD NORDSKOG, 3600 10th Ave., Los Angeles, Calif.

Reading of Electrical Drawings and Blueprints

(Dr-24x)

Every electrician, contractor, or man contemplating entering the electrical profession should be able to read electrical drawings and blueprints. The most practical principles of the subject are taught in a way that should insure quick understanding.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

READING OF ELECTRICAL DRAWINGS AND BLUEPRINTS (EE-16)—Typical drawings of a standard motor. Wiring diagrams of typical face plate and drum type manual starters, of contractor and autotransformer type automatic starters of controllers, of panels, of automotive systems, and of a wireless unit. Symbols for wiring diagrams.

Mechanical Drawing for Plumbers

(Dr-12x)

Instruction especially for plumbers. It supplies the training necessary to read drawings intelligently and accurately, and teaches how to make sketches of plumbing and piping installations.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

PLUMBING DRAWING (Dr-49)—Especially prepared instruction dealing with working drawings of pipe layouts and details. Freehand sketching of pipes and plans. Plans of complete plumbing installation. Working and detail drawings.

Reading of Heating and Plumbing Plans with Mathematics

(Dr-45x)

The plumber, the steam fitter, the apprentice, and others employed in the installation of heating and plumbing systems, must know how to interpret accurately the blueprints used in their work. Also, their opportunities for assuming greater responsibilities will be increased if they can make the mathematical calculations connected with their work. In a most practical way the Reading of Plans and necessary mathematics are covered thoroughly and in the shortest time possible.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

READING OF HEATING AND PLUMBING PLANS (ME-28)—Lessons and blueprints. Heating and plumbing symbols. Heating and plumbing plans for small houses, large houses, apartment houses and office buildings. Student is required to make complete heating and plumbing layouts for an entire building from plans.

Reading of Heating and Plumbing Plans

(Dr-44x)

Many a skilled mechanic is handicapped by his lack of ability to obtain information from blueprints. Such a man would do well to devote the necessary time to the study of this course. In so doing he will be able to bridge the gap between himself and the man in a position of responsibility, or will be able to enter into business for himself trained for success.

The apprentice plumber, or steam fitter, will find in this course the training that may shorten by many years the time when he will attain a responsible position and a future that is secure.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

READING OF HEATING AND PLUMBING PLANS (ME-28)—Heating and plumbing symbols. Small house plans. Large house plans. Apartment house plans. Office buildings. Heating and plumbing problems. Making complete heating and plumbing layouts for entire buildings.

Lettering and Sign Painting

(Dr-6x)

There is scarcely a city wall or window that does not bear some form of lettered or printed advertising appeal. Each year modern business spends millions of dollars for signs. Every store and many offices make good use of the descriptive sign in the window or on a panel.

Artistically designed signs have taken the place of the cheap and gaudy displays of the past. The modern business man appreciates the value of beauty and charm of design in display work and is ready to pay well for it.

The wide field of creative work offers the broadest opportunities to the man with acquired skill, taste and ingenuity. An experienced master of his craft has personal direction over each student's progress. Every phase of modern lettering and sign painting is covered in a comprehensive manner.

Topics Covered in This Course:

LETTERING AND SIGN PAINTING (Dr-4)—**Essentials of Lettering**—Brush stroke exercises. Alphabets. Styles of lettering. Principles of artistic layouts. Color combinations. Essentials of ornament.

Materials—Brushes. Proper use. Care. Mahl stick. Art materials. Shop equipment. Water and coach colors. Mixing colors. Stencils. Stencil brushes. Gold leaf and how to use it. Devices.

Kinds of Signs—Cardboard, Oilcloth. Permanent and temporary. Wood. Metal. Uses. Methods of construction. Stretching materials. Layouts. Designs. Backgrounds. "Cut-in" lettering. Gold leaf work. Finish and hanging.

Glass Lettering—Direct lettering. Office door work. Opal and opaque glass signs. Apartment house work. Reversed lettering. Store window work. Dead center lettering. Semi-transparent lettering and background. Illuminated glass signs. Framed glass signs.

Attached and Pasted Letters—Ready made—Wood. Metal. Gold leaf. Concave letters. Aluminum. Enameled metal signs. To order—Wood. Metal. Glass. Gilt and silvered.

Lettering on Cloth—Canvas. Mercerized cloth. Satin. Unbleached linen. Silk.

Advanced Applications—Pictorial work on glass, wood, metal. Exhibition work. Wall advertising signs. Scale drawings. Bill-board signs. Illuminated signs.

Finds the Cooperation of Y.M.C.A. Instructors a Real Help

I thank you for the little notes you have been adding on my lesson papers in Architectural Drawing. It is hard work to come home from a day's detail and set to solving problems, and I assure you your words of encouragement help a great deal. I try to put myself in your place and work out the problems just as I would like to receive them if the correcting were my part of the game. A man taking a Y.M.C.A. course cannot blame his failures on the teachers. I find cooperation and a willingness to help, and if examination plates or papers are O. K., the credit is 50/50.—JOHN J. O'MARA, Brooklyn, N. Y.

Knowledge Pays Big Dividends



ARE you one of the thousands of men who cannot go to college, whose tastes are for the designing of buildings? Perhaps you have been in practical construction work of one kind or another. But whether you have had building experience or not, you can, through the use of spare hours in studying a Y.M.C.A. Course, acquire the most essential knowledge of architecture, architectural drawing, building methods, or whatever branch of this great field appeals to you most.

The architect must exercise artistic taste as well as possess a practical knowledge of the requirements of homes, school buildings, churches, railroad stations, and the numerous other types of buildings that he is called upon to design. His work is interesting, congenial and highly remunerative. His own initiative and ability determine whether he shall remain among the mediocre workers or rise to the pinnacle of success in his profession.

Right now there are more than a million "average men" scattered from coast to coast, who are waiting to place in the hands of capable architects commissions to build their homes. Whether in the town of six hundred, six thousand, or six million, the opportunities awaiting the enterprising, skillful architect are perhaps more attractive than those of any other profession.

With the many opportunities in the building and architectural fields, large salaries are very common. Not every man may reasonably hope to climb to a salary of $5,000 to $15,000 a year, but every ambitious man can expect to earn enough in this work to support himself and family in comfort if he makes good use of his opportunities.

The character of the student is of prime importance in taking up architectural courses. These studies will develop, but they cannot create. He needs at the start the qualities of a man and in addition imagination, analytical ability, perspective, impartiality, accuracy and plenty of common sense. The first and the last are most important.

With these qualities you can study architecture, confident that future success is yours. You should waste no time in getting started, so that you may be ready to answer when opportunity knocks.

A Teacher of Experience to Guide Your Progress

WILLIAM H. STANGLE, advisory head of the Architectural Department, is a man of high reputation in his profession. Coming from one of the best known architectural schools in the country he has occupied several positions of importance. He entered the employ of the Moody Engineering Company, where in five years he was advanced from inspector to designer, and lastly to branch manager. After four years as chief designer for the Barrett Company, he became associate architect and engineer to Woodwell and Resler, prominent consulting architects and engineers of New York City.

For six years as active head of the Architectural Department of the Bedford Branch Y.M.C.A., Brooklyn, and the Pittsburgh Y.M.C.A., he made an enviable record. The large number of his former students who, today, are gaining success in this profession, are sufficient proof of the value of his methods of instruction.

Mr. Stangle takes a deep personal interest in the progress of every student. At all times he stands ready to assist the student materially in the mastery of his studies.

Surpassed His Expectations

Your course in Architectural Construction surpassed all my expectations, and the personal touches of encouragement, which do not accompany the ordinary correspondence courses, are a great incentive towards hard study. Thanking the "Y" for its generosity, and you for your interest, I am, —GEORGE F. GARRITY, Woodsville, N. H.

Complete Architecture

(Ar-3x)

The Complete Course in Architecture is a broad, comprehensive treatment of building design and construction. It comprises complete instruction and training in architectural drawing, the various branches of design, and is a most practical treatise on the many detailed subjects of building construction.

It is planned to qualify one as a designer of buildings, from both the artistic and structural standpoints, and to educate the designer in the matter of specifications, contracts, and estimates, and further to give a broad foundation of knowledge for the supervising of construction of buildings. The course also makes an excellent review for those already engaged in the profession.

The vast amount of home building to be undertaken makes this course just now one of unusual opportunity.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Development of surfaces. Intersection of surfaces. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

BUILDING MATERIALS (Ar-3)—Foundation bed. Masonry walls. Footings. Cements. Mortars. Concrete. Brick. Stone. Terra cotta. Cast iron. Steel. Wood. Fireproofing materials. Reinforced concrete. Heating and ventilation materials. Plumbing and drainage materials. Electric lighting materials. Plaster. Interior trim. Paint. Roofing. Tile. Miscellaneous equipment.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

Construction Group

BUILDING CONSTRUCTION (Ar-4)—Foundations. Excavating. Piling. Shoring. Footings. Grillage. Mortars. Concrete. Brickwork. Stonework. Piers. Arches. Structural work. Wooden framing. Interior trim. Standard mill construction. Fireproof construction. Reinforced concrete. Roof trusses. Heating and ventilation. Plumbing and drainage. Gas piping. Electric lighting. Roofing. Lathing and plastering. Painting and decorating. Miscellaneous construction.

BUILDING SUPERINTENDENCE (Ar-5)—Superintendent's duties. Relation of owner to architect. Relation of contractor to owner. Architect's drawings and details. Organization. Stores and supplies. Labor reports. Workmanship. Quality of materials. Reputation. Finances.

ESTIMATING AND COST KEEPING (Ar-6)—Ten laws of management. Rules of securing minimum cost. Piece rate. Bonus. Other systems. Measuring output of workmen. Quantity survey. Cost keeping. Office appliances and methods. Bookkeeping for small cost. Miscellaneous cost department blanks. Practical problems.

SPECIFICATION WRITING (Ar-8)—Owner. Contractor. Architect. Sub-contractors. Materials. Labor. Drawings. Details. Changes. Insurance. City laws. Building laws. Protection of public. Superintendent or foreman. Engineer in charge. Payments. Time limits. Penalties. Completion of work. Arbitration.

CONTRACTS (Ar-7)—Competitive bidding. Instruction to bidders. Submission of proposal. Form of proposal. General contracts. Subcontracts. Separate contracts. Fixed-sum contracts. Cost-plus-fee contracts. Other contract forms. Legal details. Standard contract of American Institute of Architects. Bond of suretyship. Quantity system. Progress schedule. Schedule of values. Payments.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

MECHANICS OF MATERIALS (CE-12)—Strength of materials. Deformation. Elastic change of length. Properties of materials of engineering. Beams. Theory of beams. Reaction. Vertical shear. Bending moment. Internal and external forces. Safe loads. Column formulas. Combined stresses. Axial shear. Horizontal shear. Resilience and work. Impact. Fatigue of materials. Torsion of shafts.

Spare-hour education is offered by the United Y.M.C.A. Schools on the platform of: (1) the most service for the least money; (2) careful guidance in the choice of a course for every applicant; (3) the personal interest of a competent and sympathetic teacher; (4) as much encouragement to complete a course as to begin one.

Design Group

ARCHITECTURAL DRAWING (Ar-16)—Sketch plans. Architectural symbols. Stairway circulation. Working drawings of a brick house. Working drawings of a frame house. Floor plans. Elevations. Sections. Scale and full-size details. Analysis of several existing drawings.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

ELEMENTARY PERSPECTIVE (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan method. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

THE CLASSIC ORDERS (Ar-15)—General proportions. Profile of mouldings. Tuscan order. Doric order. Ionic order. Corinthian order. Comparison of orders. Parapets and balustrades. Doors and windows. Colonnades. Arcades. Superposition. Modern applications of the classic orders.

SHADES AND SHADOWS (Ar-14)—Point of view. Conventional ray. Similarity of shadows and perspective. Shadows of a circle. Shadows of straight lines. Shades and shadows of spheres. General methods of casting shadows. Oblique projection. Circumscribing surfaces. Auxiliary shadows. Slicing method. Practical applications. Shades and shadows of cones. Shades and shadows of cylinders. Miscellaneous problems. Shades and shadows of the classic orders.

HISTORY OF ARCHITECTURE (Ar-1)—Prehistoric. Egyptian. Western Asiatic. Greek. Roman. Early Christian. Byzantine. Romanesque. Gothic. Renaissance. Colonial. American. Non-historic.

ORNAMENT (Ar-19)—Egyptian. Assyrian. Grecian. Roman. Early Christian. Byzantine. Romanesque. Gothic. Renaissance. Non-historic.

ADVANCED PERSPECTIVE (Ar-11)—Planes. Vanishing points of lines. Vanishing points of inclined lines. Various kinds of planes. Vanishing planes. Vertical planes. Ascending planes. Descending planes. Inclined planes. Oblique planes. Shadows. Reflections. General problems.

WATER-COLOR RENDERING (Ar-18)—Rendering architectural subjects. Materials used. Methods of using materials. Colors. Still life and nature sketching. Elementary problem in monotone. Commencing a water-color sketch. Elementary problem in colors. Difficulties encountered. Composition in landscape. Composition applied to architectural subjects. The silhouette. Painting from nature. Difficulties in working from nature. The importance of tone. Foliage and trees. Clouds and skies. Architectural problems. Architectural shades and shadows in monotone. Wash drawings. Finished drawing. Contemporary work.

PEN DRAWING (Ar-17)—Style. Limitations of the pen. Materials used. Technique and control. Tone. Still life. Shadows. Values, texture and color. Preliminary sketch. Elementary composition. Simple renderings. Foliage. Figures. Water and clouds. Practical problems. Architectural drawing. Aerial perspective. Skies. Ambience. Criticism of contemporary work.

HOUSE PLANNING (Ar-20)—Practical problems in planning city and country residences, schools, churches, banks, clubs, and the like.

INTERIOR DECORATION (Ar-21)—Form of room. Elevational composition. Doorways, windows, fire-places, stairways, and the like. Color. Wood finishing. Details. Hangings. Furnishings. Lighting.

ARCHITECTURAL COMPOSITION (Ar-2)—Standard of taste. What architecture is. Unity. Individuality. Similarity. Subordination. Analysis of buildings. Primary masses. Secondary masses. Details. Horizontal division. Proportion. Contrast. Practical applications. Asymmetrical compositions. Flexibility of types. Comparison and criticism.

Note: The student may take the Design Group before the Construction Group if he so desires.



A Beautiful Home

There are opportunities in every small and medium-sized town and city for architects to design beautiful, moderate-priced homes.

This house was designed by James Purdon, Architect, Dedham, Mass. Photograph by courtesy "Architecture," Charles Scribner's Sons.

Architectural Design

(Ar-1x)

To the student who is artistically inclined, this course is recommended. The course is arranged to prepare the student to be an architectural draftsman or designer. It is an advanced course, complete in the general subjects of architectural design.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Development and intersection of surfaces. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in course. Graphs and how to make them.

***TRIGONOMETRY** (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

ARCHITECTURAL DRAWING (Ar-16)—Sketch plans. Architectural symbols. Stairway circulation. Working drawings of a brick house. Working drawings of a frame house. Floor plans. Elevations. Sections. Scale and full-size details. Analysis of several existing drawings.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

ELEMENTARY PERSPECTIVE (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan method. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

THE CLASSIC ORDERS (Ar-15)—General proportions. Profile of mouldings. Tuscan order. Doric order. Ionic order. Corinthian order. Comparison of orders. Parapets and balustrades. Doors and windows. Colonnades. Arcades. Superposition. Modern applications of the classic orders.

SHADES AND SHADOWS (Ar-14)—Point of view. Conventional ray. Similarity of shadows and perspective. Shadows of a circle. Shadows of straight lines. Shades and shadows of spheres. General methods of casting shadows. Oblique projection. Circumscribing surfaces. Auxiliary shadows. Slicing method. Practical applications. Shades and shadows of cones. Shades and shadows of cylinders. Miscellaneous problems. Shades and shadows of the classic orders.

HISTORY OF ARCHITECTURE (Ar-1)—Prehistoric. Egyptian. Western Asiatic. Greek. Roman. Early Christian. Byzantine. Romanesque. Gothic. Renaissance. Colonial. American. Non-historic.

ORNAMENT (Ar-19)—Assyrian. Grecian. Roman. Early Christian. Byzantine. Romanesque. Gothic. Renaissance. Non-historic.

ADVANCED PERSPECTIVE (Ar-11)—Planes. Vanishing points of lines. Vanishing points of inclined lines. Various kinds of planes. Vanishing planes. Vertical planes. Ascending planes. Descending planes. Inclined planes. Oblique planes. Shadows. Reflections. General problems.

WATER-COLOR RENDERING (Ar-18)—Rendering architectural subjects. Materials used. Methods of using materials. Colors. Still life and nature sketching. Elementary problem in monotone. Commencing a water-color sketch. Elementary problem in colors. Difficulties encountered. Composition in landscape. Composition applied to architectural subjects. The silhouette. Painting from nature. Difficulties in working from nature. The importance of tone. Foliage and trees. Clouds and skies. Architectural problems. Architectural shades and shadows in monotone. Wash drawings. Finished drawing. Contemporary work.

PEN DRAWING (Ar-17)—Style. Limitations of the pen. Materials used. Technique and control. Tone. Still life. Shadows. Values, texture and color. Preliminary sketch. Elementary composition. Simple renderings. Foliage. Figures. Water and clouds. Practical problems. Architectural drawing. Aerial perspective. Skies. Ambience. Criticism of contemporary work.

HOUSE PLANNING (Ar-20)—Practical problems in planning city and country residences, schools, churches, banks, clubs, and the like.

INTERIOR DECORATION (Ar-21)—Form of room. Elevational composition. Doorways, windows, fire-places, stairways, and the like. Color. Wood finishing. Details. Hangings. Furnishings. Lighting.

ARCHITECTURAL COMPOSITION (Ar-2)—Standard of taste. What architecture is. Unity. Individuality. Similarity. Subordination. Analysis of buildings. Primary masses. Secondary masses. Details. Horizontal division. Proportion. Contrast. Practical applications. Asymmetrical compositions. Flexibility of types. Comparison and criticism.

**Optional.* (*See Page* 12.)

Heating and Ventilating

(Ar-4x)

This course is designed to meet the demands of the architects, engineers, and contractors, as well as their assistants, who are interested in the proper design of heating and ventilation systems.

The course is thorough and covers a broad field. A review of mathematics is given to prepare the student for the various interesting calculations. Elementary physics of mechanical and heat energy and elementary chemistry of fuels and combustion are included, as is a general training in drawing. The student will be excused from this preliminary work by satisfactorily passing an examination. The section on heating and ventilation is clear and extensive.

The text used is the most modern treatise on the subject, written in a simple, direct manner and thoroughly illustrated. Each chapter is well discussed and fully explained in supplementary lessons relating to the subject.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Development of surfaces. Intersection of surfaces. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

***TRIGONOMETRY** (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field Some of the more important graphical problems.

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by means of views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of materials.

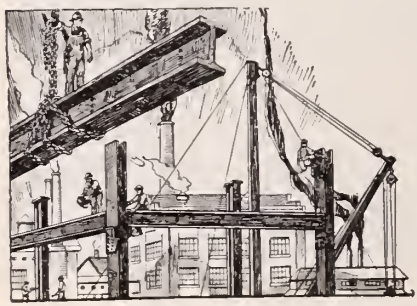
READING OF HEATING AND PLUMBING PLANS (ME-28)—Lessons and blueprints. Heating and plumbing symbols. Heating and plumbing plans for small houses, large houses, apartment houses and office buildings. Student is required to make complete heating and plumbing layouts for an entire building from plans.

CHEMISTRY (Ac-17)—Fundamental principles and the applications of chemistry necessary for the engineer. Chemical elements. Principles and laws. Nomenclature. Equations. Acids and bases. The method of recording scientific observations.

PHYSICS (Ac-26)—Simple and direct instruction dealing with the transfer of energy and the properties of matter. Heat and light. Electricity and magnetism.

HEATING AND VENTILATING (Ar-9)—Physical units and measurement of heat. Properties of water, steam and air. Heat transmission of building construction. Heat transmission of direct radiators. Radiators for direct heating. Fuels and combustion. Steam-heating boilers. Hot-water heaters. Heating water in tanks and pools. Draft and chimneys for heating. Ventilation air analysis and ventilation laws. Gravity. Indirect heating by steam and hot water. Warm-air furnace heating. Hot-blast heating. Air conditioning. Air washing. Humidifying. Cooling. Drying. Temperature and humidity control. Exhaust-steam heating. Central station or district heating. Pipe fittings, valves, and coverings. Water lines. Gas lines. Drainage systems. Preparation of plans and specifications. Estimating.

*Optional. (See Page 12.)



Canadian Student Advances from Clerk to Contractor

I might say that as far as I have gone with the course it is all and more than I expected. Since taking up the course I quit my old position as clerk and have started in building houses. I have completed one and have two others under construction. I owe this to the incentive that my course in Architectural Drawing has given me.

—R. F. HUME, Vancouver, B. C.

Architectural Construction

(Ar-2x)

This course gives thorough instruction in Architectural Drawing and Building Construction. It covers all the work in the general architectural course, and further comprises an extensive and thorough study of building construction. The course meets the requirements of the advanced student who is not particularly inclined to the artistic side of architecture, but who prefers the real construction and engineering side of the profession. It is arranged to prepare the student as an architectural engineer, building superintendent, contractor, construction engineer, building inspector, and dealer in building materials. It will assist many a carpenter, mason, foreman, and artisan to a better education and advanced knowledge of his own trade.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Development of surfaces. Intersection of surfaces. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

BUILDING MATERIALS (Ar-3)—Foundation bed. Masonry walls. Footings. Cements. Mortars. Concrete. Brick. Stone. Terra cotta. Cast iron. Steel. Wood. Fireproofing materials. Reinforced concrete. Heating and ventilation materials. Plumbing and drainage materials. Electric lighting materials. Plaster. Interior trim. Paint. Roofing. Tile. Miscellaneous equipment.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

BUILDING CONSTRUCTION (Ar-4)—Foundations. Excavating. Piling. Shoring. Footings. Grillage. Mortars. Concrete. Brickwork. Stonework. Piers. Arches. Structural work. Wooden framing. Interior trim. Standard mill construction. Fireproof construction. Reinforced concrete. Roof trusses. Heating and ventilation. Plumbing and drainage. Gas piping. Electric lighting. Roofing. Lathing and plastering. Painting and decorating. Miscellaneous construction.

ARCHITECTURAL DRAWING (Ar-16)—Sketch plans. Architectural symbols. Stairway circulation. Working drawings of a brick house. Working drawings of a frame house. Floor plans. Elevations. Sections. Scale and full-size details. Analysis of several existing drawings.

BUILDING SUPERINTENDENCE (Ar-5)—Superintendent's duties. Relation of owner to architect. Relation of contractor to owner. Architect's drawings and details. Organization. Stores and supplies. Labor reports. Workmanship. Quality of materials. Reputation. Finances.

ESTIMATING AND COST KEEPING (Ar-6)—Ten laws of management. Rules of securing minimum cost. Piece rate. Bonus. Other systems. Measuring output of workmen. Quantity survey. Cost keeping. Office appliances and methods. Bookkeeping for small cost. Miscellaneous cost department blanks. Practical problems.

SPECIFICATION WRITING *(Ar-8)—Owner. Contractor. Architect. Sub-contractors. Materials. Labor. Drawings. Details. Changes. Insurance. City laws. Building laws. Protection of public. Superintendent or foreman. Engineer in charge. Payments. Time limits. Penalties. Completion of work. Arbitration.

CONTRACTS (Ar-7)—Competitive bidding. Instruction to bidder. Submission of proposal. Form of proposal. General contracts. Subcontracts. Separate contracts. Fixed-sum contracts. Cost-plus-fee contracts. Other contract forms. Legal details. Standard contract of American Institute of Architects. Bond of suretyship. Quantity system. Progress schedule. Schedule of values. Payments.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

***MECHANICS OF MATERIALS** (CE-12)—Strength of materials. Deformation. Elastic change of length. Properties of materials of engineering. Beams. Theory of beams. Reaction. Vertical shear. Bending moment. Internal and external forces. Safe loads. Column formulas. Combined stresses. Axial shear. Horizontal shear. Resilience and work. Impact. Fatigue of materials. Torsion of shafts.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

**Optional.* (*See Page* 12.)

ELEMENTARY PERSPECTIVE (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan method. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

THE CLASSIC ORDERS (Ar-15)—General proportions. Profile of mouldings. Tuscan order. Doric order. Ionic order. Corinthian order. Comparison of orders. Parapets and balustrades. Doors and windows. Colonnades. Arcades. Superposition. Modern applications of the classic orders.

*SHADES AND SHADOWS (Ar-14)—Point of view. Conventional ray. Similarity of shadows and perspective. Shadows of a circle. Shadows of straight lines. Shades and shadows of spheres. General methods of casting shadows. Oblique projection. Circumscribing surfaces. Auxiliary shadows. Slicing method. Practical applications. Shades and shadows of cones. Shades and shadows of cylinders. Miscellaneous problems. Shades and shadows of the classic orders.

Building Contracting

(Ar-6x)

You can become a building contractor and share in the billions of dollars that are spent in this country each year on construction work.

Your profits are regulated by your ability to bid intelligently on a contract and then carry that contract through to completion. Competition in this field is keen, and in order to make a success you must have a thorough, practical knowledge of every part of your work.

This course affords an opportunity for the skilled workman who has been employed in the building trades and now wishes to strike out for himself. It is ideal for the technically trained man now employed at a comparatively small salary and who wishes to conduct a contracting business of his own. The man already engaged in construction work will find in this course the definite information he needs to develop his business most successfully.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

BUILDING MATERIALS (Ar-3)—Foundation bed. Masonry walls. Footings. Cements. Mortars. Concrete. Brick. Stone. Terra cotta. Cast iron. Steel. Wood. Fireproofing materials. Reinforced concrete. Heating and ventilation materials. Plumbing and drainage materials. Electric lighting materials. Plaster. Interior trim. Paint. Roofing. Tile. Miscellaneous equipment.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of material.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans. Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising architect.

BUILDING CONSTRUCTION (Ar-4)—Foundations. Excavation. Piling. Shoring. Footings. Grillage. Mortars. Concrete. Brickwork. Stonework. Piers. Arches. Structural work. Wooden framing. Interior trim. Standard mill construction. Fireproof construction. Reinforced concrete. Roof trusses. Heating and ventilation. Plumbing and drainage. Gas piping. Electric lighting. Roofing. Lathing and plastering. Painting and decorating. Miscellaneous construction.

BUILDING SUPERINTENDENCE (Ar-5)—Superintendent's duties. Relation of owner to architect. Relation of contractor to owner. Architect's drawings and details. Organization. Stores and supplies. Labor reports. Workmanship. Quality of materials. Reputation. Finances.

ESTIMATING AND COST KEEPING (Ar-6)—Ten laws of management. Rules of securing minimum cost. Piece rate. Bonus. Other systems. Measuring output of workmen. Quantity survey. Cost keeping. Office appliances and methods. Bookkeeping for small cost. Miscellaneous cost department blanks. Practical problems.

CONTRACTS (Ar-7)—Competitive bidding. Instruction to bidders. Submission of proposal. Form of proposal. General contracts. Subcontracts. Separate contracts. Fixed-sum contracts. Cost-plus-fee contracts. Other contract forms. Legal details. Standard contract of American Institute of Architects. Bond of suretyship. Quantity system. Progress schedule. Schedule of values. Payments.

SPECIFICATION WRITING (Ar-8)—Owner. Contractor. Architect. Sub-contractors. Materials. Labor. Drawings. Details. Changes. Insurance. City laws. Building laws. Protection of public. Superintendent or foreman. Engineer in charge. Payments. Time limits. Penalties. Completion of work. Arbitration.

*Optional. (See Page 12.)

Building Construction

(Ar-7x)

This course is for the man who desires to become foreman or superintendent of building construction. The subject matter relates to buildings of all types and for all uses, and general construction problems, such as are encountered by the general contractor on steel, wood, masonry, and concrete construction. The course is entirely practical, and will be especially valuable to the man already engaged in this line of work and who is desirous of advancing.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of material.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

BUILDING MATERIALS (Ar-3)—Foundation bed. Masonry walls. Footings. Cements. Mortars. Concrete. Brick. Stone. Terra cotta. Cast iron. Steel. Wood. Fireproofing materials. Reinforced concrete. Heating and ventilation materials. Plumbing and drainage materials. Electric lighting materials. Plaster. Interior trim. Paint. Roofing. Tile. Miscellaneous equipment.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans. Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising architect.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

BUILDING CONSTRUCTION (Ar-4)—Foundations. Excavating. Piling. Shoring. Footings. Grillage. Mortars. Concrete. Brickwork. Stonework. Piers. Arches. Structural work. Wooden framing. Interior trim. Standard mill construction. Fireproof construction. Reinforced concrete. Roof trusses. Heating and ventilation. Plumbing and drainage. Gas piping. Electric lighting. Roofing. Lathing and plastering. Painting and decorating. Miscellaneous construction. Construction machinery.

Estimating, Cost Keeping and Cost Accounting

(Ar-9x)

When you are able to make correct building estimates, when you know the operating principles of modern cost-keeping methods and the fundamental principles of cost accounting, you are well on your way toward the top.

This course, which goes into each of these subjects in a practical manner, will be of inestimable value to the many clerical workers connected in one way or another with construction work.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in course. Graphs and how to make them.

***TRIGONOMETRY** (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

ESTIMATING AND COST KEEPING (Ar-6)—Ten laws of management. Rules of securing minimum cost. Piece rate. Bonus. Other systems. Measuring output of workmen. Quantity survey. Cost keeping. Office appliances and methods. Bookkeeping for small cost. Miscellaneous cost department blanks. Practical problems.

COST ACCOUNTING (Co-4)—Principles. Cost accounting in modern business. Routine methods. Relation between general ledger and cost accounting. Indirect expense accounts. Stores and stores department. Stores accounting and records. Stores problems. Recording cost of labor. Time and pay records. Indirect expense. Schedule of fixed charges. Expense distribution. Representative cost systems. Graphic presentation of cost data. Use of charts. Forms.

*Optional. (See Page 12.)

Plan Reading and Estimating

(Ar-8x)

A course for building mechanics wishing to qualify for advancement by increasing their knowledge of mathematics, plan reading and estimating. The course includes the necessary instruction in mathematics to enable the student to perform the calculations required in connection with the studies, and to understand the principles upon which architectural drawings are based, followed by a study of problems and practice in the reading of blueprints. The modern methods of estimating are thoroughly treated. The subject of cost-keeping is broadly explained with particular reference to the up-to-date contractor's business system.

This is a course of special usefulness to contractors and their employees, who need the knowledge of reading of drawings and a thorough education in estimating and cost keeping.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of material.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans. Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising architect.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

***TRIGONOMETRY** (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

ESTIMATING AND COST KEEPING (Ar-6)—Ten laws of management. Rules of securing minimum cost. Piece rate. Bonus. Other systems. Measuring output of workmen. Quantity survey. Cost keeping. Office appliances and methods. Bookkeeping for small cost. Miscellaneous cost department blanks. Practical problems.

Estimating

(Ar-5x)

This course is arranged to give a thorough review or instruction in mathematics and an extensive training in the making of building estimates, together with the modern cost keeping methods met with in the contractor's office. It's just the sort of instruction needed by many office workers or clerical employees connected in one way or another with building operations.

Subjects Covered in This Course:

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

***TRIGONOMETRY** (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

ESTIMATING AND COST KEEPING (Ar-6)—Ten laws of management. Rules of securing minimum cost.. Piece rate. Bonus. Other systems. Measuring output of workmen. Quantity survey. Cost keeping. Office appliances and methods. Bookkeeping for small cost. Miscellaneous cost department blanks. Practical problems.

**Optional.* *(See Page 12.)*

NOTE: Training equivalent to that given in Elementary Architectural Drawing (Ar-13x), or Plan Reading with Mathematics (Ar-18x), will be necessary in order to undertake the study of this course.

Nothing is so costly as ignorance. You sow the wrong seed, you plant the wrong field, you build with the wrong timber, you buy the wrong ticket, you take the wrong train, you settle in the wrong locality, or you take the wrong medicine, and no money can make good your mistake.—Dr. Fowler.

Plan Reading

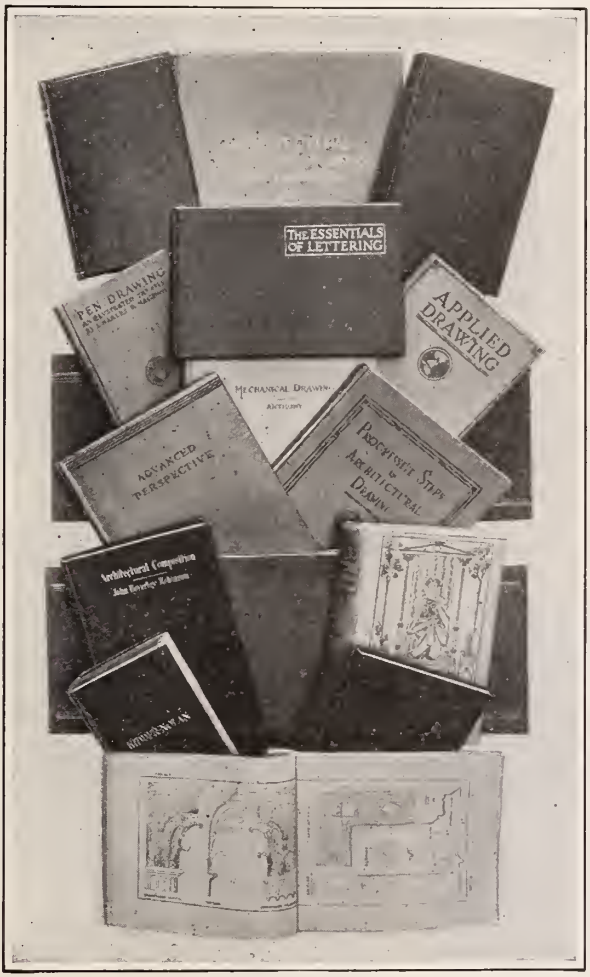
(Ar-20x)

In every sort of construction work it is essential that the man who desires to get ahead should know how to read plans correctly. This course is of especial value to building mechanics, contractors, and their employees.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by means of views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of material.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans. Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising architect.



TEXTBOOKS

Each a Recognized Authority.
The eighteen Textbooks furnished with the Complete Architectural Course. No extra charge.

Plan Reading with Mathematics

(Ar-18x)

A course for building mechanics who wish to improve their positions by increasing their knowledge of mathematics and plan reading. The course includes the necessary instruction in arithmetic and geometry, and in a particularly effective way trains the student in plan reading. Several practice problems are included to make the course more interesting and valuable.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by means of views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of material.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans. Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising architect.

Own Your Home

(Ar-19x)

The desire to own your own home is one of the primal natural instincts of every real red-blooded man and woman. You can now realize this desire by turning the rent you pay a landlord into purchasing a home of your own. With a small initial payment it is now possible to move into a dwelling that is yours. But in acquiring a home many problems confront the average buyer or builder. Millions of dollars are lost each year due to the lack of housing knowledge.

To the home builder or buyer, this course will prove of intense value. The student is given the benefit of expert instruction. The projects he studies are written by specialists of national reputation. Every problem encountered by the average builder or buyer is well covered. This course will be the means of saving many hundreds and even thousands of dollars to those who contemplate becoming home owners.

Topics Covered in This Course:

HOME OWNERSHIP (Ar-26)—Advantages of Home Ownership—Pride in possession and maintenance of home. A deed for a house rather than rent receipts.

Architectural Styles in Domestic Architecture—Prehistoric shelter. Renaissance and modern dwellings. Colonial. English. Dutch. Mission. L'Art Nouveau. Japanese. Italian. Formal and informal design.

Selection of Site—Cost. Building restrictions. Proper distances. Natural advantages. Public utilities. Street improvements. Conveniences. City and suburban lots. Country places. A clear title.

House Owning Financial Problem—Method of financing. Building and owning without a mortgage. First mortgage. Second mortgage. Contract. Cooperative savings and loan associations. Membership for saving and borrowing.

House Planning—The architect. The contractor. Design of the home. Specifications and legal documents. Cost estimate. Bids. Letting contracts.

House Building—Excavation for the house. Advantages of frame house. Advantages of masonry and fireproof construction. Carpentry. Cabinet work. Plastering. Necessity of a good roof. Sanitary plumbing. Sewage disposal. Plumbing fixtures. Heating methods. Lighting systems. Decoration. Painting. Useful apparatus and practical hardware.

Planting the Home Grounds—Drives. Walks. Shrubbery. Plants. Trees. Hedges.

When to Build and When to Buy—Season of year. Local market conditions. Remodeling advisable under favorable conditions only. Plan each step carefully. Figure costs closely. Install modern heating and plumbing systems. Requisites for a garage with a complete apparatus.

More Knowledge Increased His Earning Power

My salary has increased from $200 to $250 a month, so I sure feel justified in digging in after more.—A. N. FELTS, Santa Maria Calif.

CIVIL ENGINEERING



FRANK T. TOWNSEND

CIVIL engineering is growing in importance. Every public improvement is dependent on some department of civil engineering for its design and execution, and there are few professions which a young man can enter with greater opportunities or so high a salary at the start. In 1917 the average salary of civil engineers after ten years in practice, was between $3,000 and $4,000. Since then the average has largely increased.

Civil engineering leads to higher positions where a man may combine executive ability with technical knowledge. Some civil engineers are paid as much as $50,000, $75,000, or even $100,000 a year. These men are directors, general managers, or presidents of large companies and have found their engineering experience a necessary part of their training.

No ambitious man who chooses civil engineering as a life work need lack the necessary education. Among natural characteristics he should possess normal intelligence, honesty, health, ambition and grit, taste for mathematics, and the ability to read and write English. All else he can acquire. The Civil Engineering Courses offered by the United Y.M.C.A. Schools start from the bottom, and for this reason it is not necessary for a student to have previous preparation.

If a man gives conscientious work to a spare-hour engineering course, he will get all the knowledge he would acquire in the technical school, except shop work and laboratory experience, which may be obtained in actual practice; and he will draw a good salary while he is learning the practical work.

Arrangement of Courses

To accommodate the growing demand for specialization, we have arranged our Civil Engineering Course by groups. A diploma is given to those who complete the Civil Engineering Course (CE-25x) including two or more of the elective groups. It will indicate in which groups the student has specialized.

Those desiring shorter and more specialized programs of study will find suitable courses described in this section. The Diploma or Certificate for these courses bears the same name as that under which the course is described.

Capable Instructors Insure Results

The Civil Engineering Courses were prepared by and are under the supervision of Frank T. Townsend, C.E., Associate Member American Society of Civil Engineers, and a graduate of Rensselaer Polytechnic Institute. Mr. Townsend has had a broad experience in engineering design and construction, having been successively engaged in structural steel, railroad, water supply, and highway engineering. Formerly he was associate editor of Engineering News-Record.

In the preparation of the courses Mr. Townsend has been ably assisted by H. P. Hammond, C.E., Professor of Hydraulic and Sanitary engineering



J. A. WEYANT

at the Brooklyn Polytechnic Institute, and E. J. Squire, C.E., Associate Professor of Structural Engineering at the same school. J. A. Weyant, C.E., a graduate of Columbia University, who has had several years' practical experience in structural engineering design, is first assistant in the Civil Engineering Department and is directly in charge of the instruction work.

Civil Engineering

(CE-25x)

Civil Engineering, as described in this course, is exceedingly broad, for it covers the entire range of subjects ordinarily considered under this general classification. The man who has not the opportunity to attend college, but who wishes to obtain a broad and comprehensive training in the field of civil engineering, will find his opportunity in the program of subjects outlined here. He may be sure that after having completed the work, he will have a training that will enable him to enter the field with confidence and to give satisfaction in the positions of larger responsibility that will come to him later. The man whose college course in civil engineering has been interrupted and who wishes to complete his education by correspondence, will find a similar opportunity.

University graduates should not overlook the fact that our offering in civil engineering provides specialized training in definite branches of civil engineering. The offering is particularly advantageous for this type of men, as practical considerations are emphasized throughout.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45) Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.
All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

THE USE OF THE SLIDE RULE (CE-1)—Construction and care of rule. Various types of rules. Mechanical multiplication and division. Roots. Powers. Setting the rule to perform various arithmetical and trigonometric calculations. Locating the decimal point. How to perform a series of operations on the rule.
A practical slide rule furnished—no additional charge.

BUSINESS LAW (Co-1)—Formation of contracts. Competent parties. Operation and discharge of contracts. Discharge in bankruptcy. Contracts concerning goods. Sales of goods. Duties of seller. Duties of buyer. Bailment of goods. Contracts concerning credits. Negotiable instruments. Conduct of business through representatives. Property in land and movables. Real property. Personal property.

ENGINEERING CONTRACTS AND SPECIFICATIONS (CE-2)—Contract and bond. Advertisements. Information for bidders. Proposals. Composition of specifications both as to general and special clauses.
NOTE—Not required of students electing Building Construction Group.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined plane. Rotary motion and centrifugal force.

***MINE SURVEYING** (CE-4)—Plane surveying applied to underground work. Special equipment for underground work. Sub-surface survey methods. Maps, projections and mine models. Exploratory and magnetic surveys. Connecting the surface and underground work.
Plane Surveying (CE-3) as described on page 83 must be taken if this subject is elected.

**Optional.* (*See Page* 12.)

To Obtain a Diploma in Civil Engineering

In addition to the general subjects already listed, two of the following specialized groups are required. If more than two groups are desired they may be had at an additional cost, as listed on the rate sheet.

Helpful Suggestions Regarding Desirable Group Combinations

Municipal Engineering Groups

Group 2. Highway Engineering.
Group 5. Structural Steel Engineering.

Group 2. Highway Engineering.
Group 4. Concrete Engineering.

Group 2. Highway Engineering.
Group 5. Structural Steel Engineering.
Group 4. Concrete Engineering.

Group 7. Water Supply Engineering.
Group 6. Sewerage Engineering.

Group 2. Highway Engineering.
Group 5. Structural Steel Engineering.
Group 4. Concrete Engineering.
Group 7. Water Supply Engineering.
Group 6. Sewerage Engineering.

Road Engineering Groups

Group 2. Highway Engineering.
Group 3. Railroad Engineering.

Structural Engineering Groups

Group 5. Structural Steel Engineering.
Group 4. Concrete Engineering.

Construction Engineering Groups

Group 1. Building Construction.
Group 5. Structural Steel Engineering.

Group 1. Building Construction.
Group 4. Concrete Engineering.

Group 1. Building Construction.
Group 5. Structural Steel Engineering.
Group 4. Concrete Engineering.

Hydraulic Engineering Groups

Sanitary Engineering

Group 7. Water Supply Engineering.
Group 6. Sewerage Engineering.

Irrigation Engineering

Group 9. Irrigation Engineering.
Group 4. Concrete Engineering.

Drainage Engineering

Group 8. Drainage Engineering.
Group 4. Concrete Engineering.

Building Construction (Group 1)

BUILDING MATERIALS (Ar-3)—Foundation bed. Masonry walls. Footings. Cements. Mortars. Concrete. Brick. Stone. Terra cotta. Cast iron. Steel. Wood. Fireproofing materials. Reinforced concrete. Plumbing and drainage materials. Plaster. Interior trim. Paint. Roofing. Tile. Miscellaneous equipment.

BUILDING CONSTRUCTION (Ar-4)—Foundations. Excavations. Piling. Shoring. Footings. Grillage. Mortars. Concrete. Brickwork. Stonework. Piers. Arches. Structural work. Wooden framing. Interior trim. Standard mill construction. Fireproof construction. Reinforced concrete. Roof trusses. Heating and ventilation. Plumbing and drainage. Gas piping. Electric lighting. Roofing. Lathing and plastering. Painting and decorating. Miscellaneous construction. Construction machinery.

BUILDING SUPERINTENDENCE (Ar-5)—Superintendent's duties. Relation of owner to architect. Relation of contractor to owner. Architect's drawings and details. Organization. Stores and supplies. Labor. Reports. Workmanship. Quality of materials. Reputation. Finances.

ESTIMATING AND COST KEEPING (Ar-6)—Ten laws of management. Rules of securing minimum cost. Piece-rate bonus Measuring output of workmen. Quantity survey. Cost keeping. Office appliances and methods. Bookkeeping for small cost. Miscellaneous cost department blanks. Practical problems.

CONTRACTS (Ar-7)—Competitive bidding. Instructions to bidders. Submission of proposal. Form of proposal. General contracts. Sub-contracts. Separate contracts. Fixed sum contracts. Cost-plus-fee contracts. Other contract forms. Legal details. Standard contracts of American Institute of Architects. Bond of suretyship. Quantity system. Progress schedule. Schedule of values. Payments.

SPECIFICATION WRITING (Ar-8)—Owner. Contractor. Architect. Sub-contractors. Materials. Labor. Drawings. Details. Changes. Insurance. City laws. Building laws. Protection of public. Superintendent or foreman. Engineer in charge. Payments. Time limits. Penalties. Completion of work. Arbitration.

Highway Engineering (Group 2)

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and the use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

HIGHWAY DRAFTING (CE-5)—Making highway maps. Preparation of general plans. Plotting of cross sections, profiles, and other earthwork plans. Vertical curves. Computation of excavation and embankment. Preparing sheets of standards. Construction.

HIGHWAY SURVEYING (CE-6)—Organization, equipment and duties of field parties. Field methods for alignment, level, topography and construction surveys. Bench levels. Surveys for cross-sections. Computation and staking of curves. Field notes. Highway photography. Camp equipment and medicine.

*HYDRAULICS (CE-18)—Fundamental data. Physical properties of water. Hydrostatics.

*Optional. (See Page 12.)

Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Pressure gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

HIGHWAY ENGINEERING (CE-7)—Theory and practice in the design and construction of highways.

General Principles of Design—Analysis of the highway problem. Maximum and ruling grades. Adverse grades. Alignment and curvature. Economic considerations.

Preliminary Investigations for Roads—Reconnaissance surveys. Material surveys. Estimates of cost.

Selection of Surfacing—Low-cost construction, such as earth, sand-clay and gravel. Medium-priced roads, such as macadam and bituminous macadam. High-cost roads, such as asphalt and Tarvia types on concrete bases; concrete surfaces; wood-block; brick, and granite pavements.

Office Design—Design of road-bed or permanent way. Typical cross-sections. Drainage problems. Run-off from areas. Ditch grades. Culverts and bridges. Sub-surface drainage. Grade line. Estimate of quantities and cost. Organization of office forces. Preparation of construction plans. General cost data. Principles of city pavement design.

Construction—Rough and fine grading. Staking out construction. Inspection of construction details for various types of surfacings.

Maintenance—Oiling. Surface treatments. Patching. Resurfacing.

Railroad Engineering (Group 3)

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and the use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

RAILROAD SURVEYING (CE-9)—Preliminary conceptions. Theory computation and staking out simple curves, compound curves, reverse curves, parabolic curves, vertical curves, turnouts and switches, connecting tracks and crossings, spiral easement curves. Special problems. Use of curve tables. Setting slope stakes. Computation of earthwork quantities. Computation of haul.

***HYDRAULICS** (CE-18)—Fundamental data. Physical properties of water. Hydrostatics. Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

RAILROAD ENGINEERING (CE-10)—Economic theory of railway location, construction, equipment and maintenance.

Railroad Finances—Organization. Issuing stocks and bonds. Estimates for construction and operation. Failures. Dangers of over-capitalization and stock watering.

Location and Construction—Preliminary surveys. Alignment location. Construction surveys. Construction of the permanent way.

Track—Rails and rail fastenings. Cross-ties and their preservation. Ballast and roadbed. Culverts and bridges. Turnouts, side tracks and yards. Elevation of the outer rail. Signaling.

Equipment and Operation—The locomotive and its work. Effect of distance, rise and fall, and curvature on operating train-mile costs. Effect of the number of trains on operating cost, assuming a constant tonnage.

Maintenance—Problems in connection with changes of distance, rise and fall, and curvature. Betterment surveys. Repairs. Railroad expenditures in fixed charges and operating expense. Evaluation of railroads.

Concrete Engineering (Group 4)

***ADVANCED ALGEBRA** (Ma-25)—A thorough study of the algebraic principles most useful and helpful to the practical man.

***ANALYTIC GEOMETRY** (Ma-24)—Selected lessons treating of the relation between the equation and the graph. This subject is particularly helpful in the field of engineering.

***CALCULUS** (Ma-8)—A simple and direct treatment of both branches of the calculus applied to problem in dynamics and civil engineering. Many interesting problems are discussed.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

PRINCIPLES OF STRUCTURAL ENGINEERING (CE-8)—Outer and inner forces. Live and dead load. Wind and snow loads. Impact. Summary of laws of statics. Reactions. Shears and moments. Graphic statics. Concentrated load systems. Engine diagrams. Maximum shears and moments. Beam design. Computation of stresses in statically determinate trusses by various methods. Design of a complete roof truss.

CONCRETE ENGINEERING (CE-14)—Design, estimating and construction of reinforced concrete beams, columns, retaining walls, floors, buildings and bridges.

Physical Characteristics of Reinforced Concrete—Properties and proportioning of concrete. Properties of steel. Properties of concrete and steel in combination.

Rectangular Beams, T-Beams and Slabs—Flexure formulas for plain and reinforced concrete beams. Shearing and inclined tensile stresses. Web reinforcement. Bond stress. Vertical and inclined reinforcement by bent rods and stirrups. Arrangement of reinforcement. Economical proportioning. Beam deflection. Beam design. Design of slabs. Design of T-Beams. Distribution of loads. Beams reinforced at top and bottom. Continuous beams. Tables and diagrams for the design of beams. T-beams and slabs.

Columns—Design of plain concrete columns.

**Optional.* (*See Page* 12.)

Longitudinal reinforcement of columns. Band reinforcement. Use of structural steel shapes. Tests. Design by various column formulas. Tables and diagrams for the design of columns. Bending and direct stress.

Retaining Walls—Theory, stability and design of plain concrete walls. Design of reinforced cantilever and counterforted walls. Special designs. Wall construction and estimating.

Design of Buildings—Floor design with monolithic beam and girder construction, with the use of one-way hollow tile, cantilever and flat slab construction. Steel frame construction with flat slabs. Distribution of loading. Placing machinery. Waterproofing. Testing. Roofs. Columns. Foundations. Walls and partitions. Stairs. Elevator shafts, etc. Construction of forms. Bending and placing reinforcement. Handling concrete. Finishing concrete surfaces. Construction plant. Materials. Sheer and moment in continuous floors and beams. Eccentric loads on columns. Estimating reinforced concrete buildings.

Bridges—Beam bridges. Girder bridges. Estimating and construction. Forms.

Structural Steel Engineering (Group 5)

***ADVANCED ALGEBRA** (Ma-25)—A thorough study of the algebraic principles most useful and helpful to the practical man.

***ANALYTIC GEOMETRY** (Ma-24)—Selected lessons treating of the relation between the equation and the graph. This subject is particularly helpful in the field of engineering.

***CALCULUS** (Ma-8)—A simple and direct treatment of both branches of the calculus applied to problems in dynamics and civil engineering. Many interesting problems are discussed.

STRUCTURAL DRAFTING (CE-16)—Definitions and general methods. Plate layouts. Steel shapes. Shop drawings for beams. Channels and their connections. Plate girders. Roof trusses. Columns. Bridge trusses. Mill buildings. Checking and correcting drawings. Bills of materials. Shop bills. Shipping bills. Miscellaneous drawings and lists.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

PRINCIPLES OF STRUCTURAL ENGINEERING (CE-8)—Outer and inner forces. Live and dead load. Wind and snow loads. Impact. Summary of laws of statics. Reactions. Shears and moments. Graphic statics. Concentrated load systems. Engine diagrams. Maximum shears and moments. Beam design. Computation of stresses in statically determinate trusses by various methods. Design of complete roof truss.

STRUCTURAL STEEL ENGINEERING (CE-17)—Application of the theory of structures to structural steel design.

Plate Girder Design—The theory. Determination of rivet spacing. Design of details such as stiffeners, cover plates, end-connections, connection angles, splices and splice fillers. Complete design of a deck plate girder bridge.

Trusses—Various types of trusses and the computation of stresses due to dead and live load by analytical and graphical methods. The use of the influence line in studying load effects. Maximum shears and bending moments due to Cooper's engine loadings. Trusses with non-parallel chords. Trusses with complicated and secondary web systems. Multiple web systems. Computation of stresses in lateral bracing. Elastic and non-elastic deflections.

Truss Design—Proportioning the cross-sections of tension and compression members. Design of truss joints. Design of bracing.

Sewerage Engineering (Group 6)

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and the use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

HYDRAULICS (CE-18)—Fundamental data. Physical properties of water. Hydrostatics. Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

SEWERAGE ENGINEERING (CE-19)—Application of hydraulics to the drainage and disposal of city wastes.

Design, Terms, Data—Definitions. Population studies and estimates of future requirements. Water consumption studies. Rainfall determinations. Run-off formulas. Sewer gaugings. Sewer surveys. Cost estimating.

Sewer Design—Design of separate systems. Rational method of storm-water sewer design. Design of combined systems. The hydraulics of sewers. Sewer appurtenances, manholes, catch-basins, inlets, etc.

Construction—Surveys. Sheeting and bracing in trenching. Construction of pipe, brick and concrete sewers.

Sewage Disposal—Chemical and biological characteristics of sewage. Sedimentation and sceptic processes. Imhoff and activated sludge processes. Sludge and contact beds. Trickling filters. Sand filters and disinfection. Disposal by irrigation processes.

**Optional.* (*See Page* 12.)

Water Supply Engineering (Group 7)

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and the use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

HYDRAULICS (CE-18)—Fundamental data. Physical properties of water. Hydrostatics. Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

WATER SUPPLY ENGINEERING (CE-20)—Sources of potable water supplies and the methods of designing and constructing works for their utilization.

Quantity, Source and Quality of Water Supply—Quantity required for cities, per capita. Estimating future requirements. Sources of supply—rainfall and evaporation, percolation and flow in streams. Quality of various supplies from physical, chemical and bacteriological standpoints. Chemical and microscopic methods of examination. Communicable diseases and their relation to water supplies.

Works for Collection of Water—General principles of construction. River and lake intakes. Ground water. Supplies from springs and wells. Reservoirs and dams. Timber, masonry, steel and loose-rock dams and their construction.

Works for Purification of Water—Sedimentation and slow sand filtration. Rapid sand filtration. Construction of filters. Miscellaneous processes.

Works for Distribution of Water—Pipes, pipe lines and conduits. Masonry aqueducts and canals. Equalizing reservoirs and their relation to pumping. Pumping machinery. Cost, operation and maintenance.

Drainage Engineering (Group 8)

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and the use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

HYDRAULICS (CE-18)—Fundamental data. Physical properties of water. Hydrostatics. Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

DRAINAGE ENGINEERING (CE-21)—Design, construction, operation and maintenance of drainage systems.

Collection of General Data—Development of land drainage. Qualifications and opportunities of the drainage engineer. Preliminary surveys and estimates. Run-off from underdrained areas. Run-off from large areas.

Open Drainage—Soil drainage by open channels. Flow in open channels. Location and construction of ditches and the problems connected therewith.

Under-Drainage—Location and construction of under-drains. Flow in under-drains. Proper size of tile drains.

Special Drainage Problems—Organization of drainage districts and their operation. Design, construction and maintenance of levee drainage systems. Reclamation of tidal lands. Drainage of irrigated lands. Drainage of muck and peat lands. Control of hill waters. Drainage of home surroundings. Cost estimates of drainage construction, operation and maintenance.

Irrigation Engineering (Group 9)

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and the use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

HYDRAULICS (CE-18)—Fundamental data. Physical properties of water. Hydrostatics. Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

IRRIGATION ENGINEERING (CE-22)—Design, construction, operation and maintenance of irrigation projects.

Preliminary Conceptions—General features of

irrigation. Its history. Work of the United States Reclamation Service. Legal considerations and its importance as a social factor.

Hydrology of Irrigation—Rainfall. Evaporation. Seepage. Stream flow. Water storage. Floods and droughts. Hydraulics as applied to irrigation.

Application of Water to Land—Water required for plant growth. Harmful effects of excessive irrigation. Water logging of the soil. Mosquitoes and malarial effects. Danger from alkali water. Irrigation by flooding. Irrigation by furrowing.

Works for Irrigation—Classification and description. Study of the various forms of canals. Slope and alignment of canals. Head works. Sluice ways and regulators. Distributing tubes and pipes. Dams, reservoirs and weirs. Pumps and pumping. Operation of irrigation systems.

Principles of Structural Engineering

(CE-13x)

Proper design of any engineering structure is based upon certain fundamental theories. It is impossible to make such designs unless these basic principles are thoroughly understood. The course develops the principles for the student and shows their application to steel structures. The study should be interesting to structural draftsmen and others who wish to increase their efficiency by acquiring a better knowledge of the fundamental principles of structural design.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined plane. Rotary motion and centrifugal force.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Cantilever and simple beams. Elastic deflection of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

PRINCIPLES OF STRUCTURAL ENGINEERING (CE-8)—Fundamental theories upon which the design of engineering structures are based and their application.

Outer and Inner Forces—Live and dead load. Weights of trusses. Wind loads. Show loads. Impact. Factors of safety.

Laws of Statics—Reactions, methods of computation and points of application. Shears and moments, their graphical representation. Influence lines.

Concentrated Load Systems—Moments and shears at fixed sections. Girders without floor beams. Engine diagrams. Shears in girders with floor beams. Maximum moments and shears at critical sections. Beam design. Stresses in statically determinate trusses, algebraic solution, solution by moments and shears, solution by graphical methods. Graphical determinations of reactions. Design of a complete roof truss.

Student says: "The Personal Touch That Your Letters Have is What Counts"

I am very grateful to the Staff of the Y.M.C.A. Schools for the cooperation and encouragement they have given me. It seems as though I am receiving letters from friends. I know and I do believe that it is the feature that will make the Y.M.C.A. Schools famous. The personal touch that your letters have is what counts and I look for the Schools to become the best of their kind in the world if not the largest, but I hope that they will never forget or let system overcome that important phase of the personal contact through letters.

If you have any inquiries from prospective pupils in this locality, I would be glad if you would refer to my name, or have them see me for recommendation of your courses.

—FOREST O. MAVIS, 646 E. Ohio Avenue, Mount Vernon, Ohio.

Gains Position of Inspecting Engineer

Through the knowledge gained by practical experience and your course in Building Construction I have been able to take and hold a position on the City Engineering Staff. My position has been that of inspecting engineer.—WARREN A. FORD, 821 E. Fifth St., Tuscon, Arizona.

Structural Steel Engineering

(CE-17x)

Exceptional opportunities are open to those who choose structural steel engineering as a profession. Steel is probably our most reliable building material. Its properties are better understood than those of any other substance. On account of this fact it has been possible to build up accurate methods of design. As a result, the steel structures of today are not only safe, but have been built with the utmost economy of material. It may therefore be understood that those engaged in the work of structural engineering, from the detailer to the engineer in charge, must have a comprehensive grasp of the fundamental principles involved in their particular work and a detailed knowledge of their practical applications.

It is a most comprehensive course for structural steel draftsmen who desire to become checkers, estimators or designers, and is also entirely adequate for the man who desires to become a structural steel engineer.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.
All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings for objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

STRUCTURAL DRAFTING (CE-16)—Definitions and general methods. Plate layouts. Steel shapes. Shop drawings for beams. Channels and their connections. Plate girders. Roof trusses. Columns. Bridge trusses. Mill buildings. Checking and correcting drawings. Bills of material. Shop bills. Shipping bills. Miscellaneous drawings and lists.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined lane. Rotary motion and centrifugal force.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

PRINCIPLES OF STRUCTURAL ENGINEERING (CE-8)—Outer and inner forces. Live and dead load. Wind and snow loads. Impact. Summary of law of statics. Reactions. Shears and moments. Graphic statics. Concentrated load systems. Engine diagrams. Maximum shears and moments. Beam design. Computation of stresses in statically determinate trusses by various methods. Design of a complete roof truss.

STRUCTURAL STEEL ENGINEERING (CE-17)—Application of the theory of structures to structural steel design.

Plate Girder Design—The theory. Determination of rivet spacing. Design of details such as stiffeners, cover plates, end-connections. Complete design of a deck plate girder connection angles, splices and splice fillers.

Trusses—Various types of trusses and the computation of stresses due to dead and live load by analytical and graphical methods. The use of the influence line in studying load effects. Maximum shears and bending moments due to Cooper's engine loadings. Trusses with non-parallel chords. Trusses with complicated and secondary web systems. Multiple web systems. Computation of stresses in lateral bracing. Elastic and non-elastic deflections.

Truss Design—Proportioning the cross sections of tension and compression members. Design of truss joints. Design of bracing.

"It is amazing what you can do with your spare time and what your spare time can do for you. Almost all of you waste enough hours in four years to give you what might be the equivalent of a college education. And remember it is what is in your brain that is your best capital."—Dr. Frank Crane.

Concrete Engineering

(CE-15x)

Reinforced concrete construction has developed rapidly in the last ten or fifteen years. Students graduating from technical schools prior to 1905 received little, if any, instruction in this subject. Today the increasing demand for concrete work gives opportunities for those who wish to progress with the industry and profit by their resourcefulness or inventive genius.

The Complete Concrete course will be interesting to men who desire to enter this broad field, and to those older engineers whose education did not include concrete design. It is particularly adapted to the needs of ambitious men who are working as draftsmen or in any other subordinate positions in the concrete engineering field.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawing of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined plane. Rotary motion and centrifugal force.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

PRINCIPLES OF STRUCTURAL ENGINEERING (CE-8)—Outer and inner forces. Live and dead load. Wind and snow loads. Impact. Summary of laws of statics. Reactions. Shears and moments. Graphic statics. Concentrated load systems. Engine diagrams. Maximum shears and moments. Beam design. Computation of stresses in statically determinate trusses by various methods. Design of a complete roof truss.

CONCRETE ENGINEERING (CE-14)—Design, estimating and construction of reinforced concrete beams, columns, retaining walls, floors, buildings and bridges.

Physical Characteristics of Reinforced Concrete—Properties and proportioning of concrete. Properties of steel. Properties of concrete and steel in combination.

Rectangular Beams, T-Beams and Slabs—Flexure formulas for plain and reinforced concrete beams. Shearing and inclined tensile stresses. Web reinforcement. Bond stress. Vertical and inclined reinforcement by bent rods and stirrups. Arrangement of reinforcement. Economical proportioning. Beam deflection. Beam design. Design of slabs. Design of T-beams. Distribution of loads. Beams reinforced at top and bottom. Continuous beams. Tables and diagrams for the design of beams, T-beams and slabs.

Columns—Design of plain concrete columns. Longitudinal reinforcement of columns. Band reinforcement. Use of structural steel shapes. Tests. Design by various column formulas. Tables and diagrams for the design of columns. Bending and direct stress.

Retaining Walls—Theory, stability and design of plain concrete walls. Design of reinforced cantilever and counterforted walls. Special designs. Wall construction and estimating.

Design of Buildings—Floor design with monolithic beam and girder construction, with the use of one way hollow tile, cantilever and flat slab construction. Steel frame construction with flat slabs. Distribution of loading. Placing machinery. Waterproofing. Testing. Roofs. Columns. Foundations. Walls and partitions. Stairs. Elevator shafts, etc. Construction of forms. Bending and placing reinforcement. Handling concrete. Finishing concrete surfaces. Construction plant. Materials. Shear and moment in continuous floors and beams. Eccentric loads on columns. Estimating reinforced concrete buildings.

Bridges—Beam bridges. Girder bridges. Estimating and construction. Forms.

Plain Concrete Construction

(CE-14x)

Those who have already undertaken to use concrete in its simpler applications have realized the difficulty of obtaining a mixture of the proper strength and durability, of constructing the proper types of forms, and of pouring the concrete in a way to secure durable and attractive results. The man who plans to undertake simple concrete construction for the first time should realize that such difficulties exist and should secure the necessary training to carry his work through to successful completion.

This course is written in simple language that is easy to understand by one who has no previous training. It takes up everything necessary to know in order to make plain concrete walks, walls, buildings, and the like, and gives the training in an interesting and practical way.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

READINGS OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of material.

PLAN READING (Ar-23)—Universally used structural shapes. Scales used in drawing. Structural details. Architectural drawing. Floor plans. Elevations. Architectural symbols. Procedure in reading a set of house plans. Sectional elevations of a house. Study of practical house plans prepared by a practising architect.

PLAIN CONCRETE CONSTRUCTION (CE-13)—Manufacture of plain concrete and the construction of the necessary forms for concrete structures.

Materials—Cements. Limes. Specifications and tests. Fine aggregates. Course aggregates. Preparation of aggregates and their proportioning.

Manufacture—Construction of forms. Mixing of materials. Placing concrete. Reinforcing small structures. Strength of structures. Finishing concrete surfaces. Stucco and plaster work. Waterproofing and coloring concrete. Manufacture of precast concrete shapes.

Applications of Plain Concrete to Various Structures—Construction of sidewalks, floors, roads, tanks, cisterns, silos, and small highway bridges and culverts.

Mechanics

(CE-11x)

A sound knowledge of the fundamental principles of the equilibrium of forces in engineering structures and machines is of primary importance to the student or engineer. This science of forces is called mechanics. The object of this course is to present the fundamentals of the subject in the shortest time consistent with thoroughness, and to deal primarily with its applications to engineering.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICS (CE-11)—General principles covering the laws of statics and motion.

Statics—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia.

Motion and Machines—Laws of friction. Kinetics. Uniform and accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy. Heat. The inclined plane.

The United Y.M.C.A. Schools, with spare-hour classes in hundreds of cities, and with a well-organized division of correspondence instruction, can bring to you the advantages given in the past year to over 140,000 *young men.*

Mechanics of Materials

(CE-12x)

Mechanics of Materials is the science that treats of the effects of forces in causing changes in the sizes and shapes of bodies. It is of great importance in the design of all types of structures and machines. Those engaged in engineering who have not already had this training should not overlook this opportunity to acquire it.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined plane. Rotary motion and centrifugal force.

MECHANICS OF MATERIALS (CE-12)—The effects of forces in causing stress and strain in bodies.

Elasticity and Strength of Materials—Elastic limit. Ultimate strength. Elastic and ultimate deformations. Modulus of elasticity. Yield point. Properties of materials. Simple stress.

Theory of Beams—Reactions. Bending moment. Shear. Internal and external forces. The neutral axis and surface. Center of gravity. Moment of inertia. Simple and cantilever beams. Shear and moment diagrams. Maximum shears and moments. Safe loads. Economic sections. Rupture. Moving loads. Elastic deflections. Overhanging and fixed beams.

Columns and Struts—General theory. Investigation of columns. Safe loads. Design by various column formulas. Miscellaneous considerations. Torsion of shafts. Apparent combined stresses. Horizontal shear in beams. Resilience and work. Impact. Fatigue of metals.

Railroad Engineering

(CE-10x)

Approximately twenty billions of dollars are estimated to be invested in the railroads of the United States. One of the vital problems of railroad directors and managers is the proper expenditure of immense sums in building and maintaining their roads and equipment in order to attain the greatest possible efficiency and safety at the lowest possible cost.

In order to do this they are obliged to keep constantly in their employ thousands of trained civil engineers. Our course gives the necessary training. It should be of value to those desiring to enter the railroad field, and to those now occupying minor positions, such as rodman, instrumentman, or assistant engineer, who wish to advance to higher positions, such as resident engineer, division engineer, or chief engineer.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

RAILROAD SURVEYING (CE-9)—Preliminary conceptions. Theory, computation and staking out of simple curves, compound curves, reverse curves, parabolic curves, vertical curves, turnouts and switches, connecting tracks and crossings, spiral easement curves. Special problems. Use of curve tables. Setting slope stakes. Computation of earthwork quantities. Computation of haul.

RAILROAD ENGINEERING (CE-10)—Economic theory of railway location, construction, equipment and maintenance.

Railroad Finances—Organization. Issuing stocks and bonds. Estimates for construction and operation. Failures. Dangers of over-capitalization and stock watering.

Location and Construction—Preliminary surveys. Alignment location. Construction surveys. Construction of the permanent way.

Track—Rails and rail fastenings. Cross-ties and their preservation. Ballast and roadbed. Culverts and bridges. Turnouts, side tracks and yards. Elevation of the outer rail. Signaling.

Equipment and Operation—The locomotive and its work. Effect of distance, rise and fall, and curvature on operating train-mile costs. Effect of the number of trains on operating cost, assuming a constant tonnage.

Maintenance—Problems in connection with changes of distance, rise and fall, and curvature. Betterment surveys. Repairs. Railroad expenditures in fixed charges and operating expense. Evaluation of railroads.

Railroad Surveying

(CE-9x)

The ground work of railroad engineering is plane surveying applied to railroad problems. Nowhere are a greater variety of survey problems found than in railroad location, relocation and construction. The problems are often intricate and require the exercise of great ingenuity on the part of the surveyor. The course gives instruction in the most approved methods of solving such problems and serves as an entrance to the railroad engineering field. It gives the needed training for axmen, chainmen or rodmen, who wish to advance to the higher position of instrumentman or assistant engineer.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

RAILROAD SURVEYING (CE-9)—General discussion of the survey methods used in locating and constructing railroads.

Preliminary Conceptions—Reconnaissance surveys. Preliminary surveys. Location surveys. Preliminary estimates.

Theory, Computation and Staking Out of Railway Curves.—Deflection methods. Tape and picket methods, by deflection distances, etc. Compound curves. Reverse and parabolic curves. Turnouts and switches. Ladder tracks. Connecting tracks and crossings. Spiral easement curves. Special tables. Special curve problems. Computation of vertical curves.

Construction Surveys and Computations—Setting slope stakes for earthwork. Computation of earthwork quantities by average and areas, by the prismoidal formula and by tables and diagrams. Computation of haul by formulas and by the mass diagram.

Highway Engineering

(CE-8x)

Highway engineering is the most rapidly developing department in civil engineering, due to a growing demand for better roads and to the law granting Federal aid to road building in every state. Approximately one billion dollars is now appropriated for highway construction in the United States. It is certain there will be many opportunities for employment in that field for many years to come in almost every county in the United States. The Complete Highway Course aims to prepare those who wish to enter this broad field and will be especially valuable to those now employed in minor positions in highway or railway work who wish to equip themselves for better positions.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representations. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

HIGHWAY DRAFTING (CE-5)—Making highway maps. Preparation of general plans. Plotting of cross sections, profiles and other earthwork plans. Vertical curves. Computation of excavation and embankment. Preparing sheets of standards. Construction.

HIGHWAY SURVEYING (CE-6)—Organization, equipment and duties of field parties. Field methods for alignment, level, topography and construction surveys. Bench levels. Surveys for cross-sections. Computation and staking of curves. Field notes. Highway photography. Camp equipment and medicine.

HIGHWAY ENGINEERING (CE-7)—Theory and practice in the design and construction of highways.

General Principles of Design—Analysis of the highway problem. Maximum and ruling grades. Adverse grades. Alignment and curvature. Economic considerations.

Preliminary Investigations for Roads—Reconnaissance surveys. Material surveys. Estimates of cost.

Selection of Surfacing—Low cost construction, such as earth, sand-clay and gravel. Medium priced roads, such as macadam and bituminous macadam. High cost roads, such as asphalt and Tarvia types on concrete bases; concrete surfaces; wood-block; brick and granite pavements.

Office Design—Design of road-bed or permanent way. Typical cross-sections. Drainage problems. Run-off from areas. Ditch grades. Culverts and bridges. Sub-surface drainage. Grade line. Estimate of quantities and cost. Organization of office forces. Preparation of construction plans. General cost data. Application of highway principles to city pavement design.

Construction—Rough and fine grading. Staking out construction. Inspection of construction details for various types of surfacings.

Maintenance—Oiling. Surface treatments. Patching. Resurfacing.

Highway Surveying

(CE-7x)

Surveying must be understood by all who work in highway departments, since it will be a large part of their work and they will be assigned to it as may be required.

Surveys for highway improvements are merely applications of plane surveying to highway problems. The study will be interesting to those engaged in the minor positions of highway construction who wish to advance to the more important positions; also, to those who wish to gain entrance to highway construction work.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

HIGHWAY DRAFTING (CE-5)—Making highway maps. Preparation of general plans. Plotting of cross-sections; profiles, and other earthwork plans. Vertical curves. Computation of excavation and embankment. Preparing sheets of standards. Construction.

HIGHWAY SURVEYING (CE-6)—Organization methods and records for highway surveys.

Alignment Surveys—Party organization. Duties of personnel. Field equipment. Field methods, by azimuths, by deflection angles. Highway curves, their solution and staking in the field. Special tables. Field notes. Solution of special problems in highway curves. Referencing surveys to the true north. Camp equipment and medicine.

Level Surveys—Party organization, equipment and duties. Profiles. Cross-sections. Bench levels. Field notes.

Topography Surveys—Party organization, equipment and duties. Location of buildings, fences, property lines, pole lines, trees, etc. Right of way surveys. Field notes. Highway photography.

Construction Surveys—Party organization, equipment and duties. Special curve methods. Staking out earthwork and highway structures. Form of records.

Highway Drafting

(CE-2x)

Learn highway drafting and be in line for continuous employment. It is the part of highway engineering which is done in the slack seasons. The subject includes instruction in a variety of work which is not essentially drafting, but which is generally done by draftsmen in connection with the preparation of plans. It should be interesting to highway surveyors, axmen, chainmen, rodmen and inspectors as a valuable addition to their other training.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

HIGHWAY DRAFTING (CE-5)—Preparation of highway plans and estimates.

Maps and Conventional Signs—Preparation of title sheets. Alignment plotting. Plotting of topography. Earthwork plans—reduction of level notes and plotting of cross-sections. Plotting the profile and grade line. Computation of vertical curves. Applying the designed cross-sections to the existing cross-sections. Measurement and computation of excavation and embankment.

Final Plans—Preparation of sheets of standards. Tracing the final plans.

Plane Surveying

(CE-1x)

Plane surveying is a most interesting and healthful vocation for a young man. The opportunities for advancement to better paying positions are many.

The principles and practical methods of ordinary land surveying are given in this course. Men employed in survey work, those who contemplate entering this field, contractors, superintendents, inspectors, and time clerks who desire to advance to the position of resident engineer, will find this course very useful.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47) Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—General theory and practical methods.

Preliminary Conceptions and Definitions—Lines and levels. Types of surveys. Surveying expressions.

Instruments and Their Care—Chains and tapes. Verniers and level bubbles. The compass. Wye and dumpy levels. The transit. Special instruments. Adjustment of instruments.

Methods—Differential and profile leveling. Determination and measurement of angles, with the compass, and with the transit. Corrections for magnetic declination. Land survey computations, such as, balancing the survey, computing areas and supplying omissions. Method of plotting by coordinates. Special problems. Special office instruments. Determination of the meridian, latitude, longitude and time by the use of the ordinary transit and by the use of special attachments.

Surveying Practice—Land surveys. U. S. public land surveys. Laying out curves. Topographic surveying. Stadia measurements. Mapping. Earthwork computations. Hydrographic surveys. City surveys. Judicial functions of the surveyor.

Mine Surveying

(CE-5x)

Mines are the source of a large part of our natural wealth and have a wide influence upon our industries. Therefore, the profession of mine surveying is connected with a very important part of our industrial life. In all surveying there is the zest of exploration, but in mine surveying this is doubly the case, because the mine surveyor takes his bearings and maps his underground course from an invisible starting point at the surface. Commensurate with the added difficulties, the mine surveyor is generally better paid than the ordinary land surveyor, and it is a lucrative profession in regions where mines exist. This course should prove of interest to land surveyors who wish to add subsurface work to their practice.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later

in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47) Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and use of the level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

MINE SURVEYING (CE-4)—Application of plane surveying methods to underground work.

General Considerations and Principles—Contrast between surface and sub-surface surveys. Coal and mineral mining claims. Definitions of the technical terms used in mine work. Special equipment and instruments for mine surveying. Instrument adjustments.

Underground Survey Methods—Surveying for details in the mine. Steep transit sights. Shaft plumbing. Tunnel surveys. Exploratory surveys. Magnetic surveys. Special mine surveys and problems.

Office Practice—Traverse calculations. Maps and projections. Surface and mine models.

Water Supply Engineering

(CE-21x)

Water supply is one of the oldest branches of engineering, yet it has developed more both scientifically and in volume in the last half century than in all the centuries preceding. There are new inventions and discoveries every year, and there is no profession in which there is a better chance for productive research than in water supply. The work is also very interesting. The subject is a part of Municipal and Sanitary Engineering and should be of interest to those who are engaged in city departments and to all who wish to enter public work of this character.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching. *All necessary drawing equipment, including instruments, furnished—no additional cost.*

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined plane. Rotary motion and centrifugal force.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

HYDRAULICS (CE-18)—Fundamental data. Physical properties of water. Hydrostatics. Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Pressure gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through

tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

WATER SUPPLY ENGINEERING (CE-20)—Sources of potable water supplies and the methods of designing and constructing works for their utilization.

Quantity, Source and Quality of Water Supply—Quantity required for cities, per capita. Estimating future requirements. Sources of supply—rainfall and evaporation, percolation and flow in streams. Quality of various supplies from physical, chemical and bacteriological standpoints. Chemical and microscopic methods of examination. Communicable diseases and their relation to water supplies.

Works for Collection of Water—General principles of construction. River and lake intakes. Ground-water. Supplies from springs and wells. Reservoirs and dams. Timber, masonry, steel and loose-rock dams and their construction.

Works for Purification of Water—Sedimentation and slow sand filtration. Rapid sand filtration. Construction of filters. Miscellaneous processes.

Works for Distribution of Water—Pipes, pipe lines and conduits. Masonry aqueducts and canals. Equalizing reservoirs and their relation to pumping. Pumping machinery. Cost, operation and maintenance.

Sewerage Engineering

(CE-20x)

Sewerage is related to hydraulic and sanitary engineering. While there were few sewer systems fifty years ago, they are common in cities and towns of the United States today. They are being increasingly required by law as a sanitary necessity. They must be designed and constructed, and should be operated by engineers. Engineers are well paid in this branch of civil engineering and the work is interesting. The course will be useful to those who wish to enter municipal engineering work, or to assistants who wish to advance.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching. *All necessary drawing equipment, including instruments, furnished—no additional cost.*

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographic maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Descriptions, adjustment and use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined plane. Rotary motion and centrifugal force.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

HYDRAULICS (CE-18)—Fundamental data. Physical properties of water. Hydrostatics. Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Pressure gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

SEWERAGE ENGINEERING (CE-19)—Application of hydraulics to the drainage and disposal of city wastes.

Design Terms and Data—Definitions. Population studies and estimates of future requirements. Water consumption studies. Rainfall determinations. Run-off formulas. Sewer gaugings. Sewer surveys. Cost estimating.

Sewer Design—Design of separate systems. Rational method of storm water sewer design. Design of combined systems. The hydraulics of sewers. Sewer appurtenances, manholes, catch basins, inlets, etc.

Construction—Surveys. Sheeting and bracing in trenching. Construction of pipe, brick and concrete sewers.

Sewage Disposal—Chemical and biological characteristics of sewage. Sedimentation and septic processes. Imhoff and activated sludge processes. Sludge and contact beds. Trickling filters. Sand filters and disinfection. Disposal by irrigation processes.

Drainage Engineering

(CE-22)

Land drainage grows in importance as unoccupied arable land decreases and land values increase. Since this is the general trend throughout the world, the profession of drainage engineering is bound to become more and more important. It is, therefore, an excellent field for the young engineer, and one which will offer greater opportunities as time passes. The course gives information that enables the student to design, construct and supervise drainage systems. It will be of interest to county surveyors, to men who wish to advance from lower positions in drainage work, and to those who have drainage systems under their supervision, such as county engineers.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching. *All necessary drawing equipment, including instruments, furnished—no additional cost.*

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined plane. Rotary motion and centrifugal force.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate deformation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience and work. Impact. Fatigue of metals.

HYDRAULICS (CE-18)—Fundamental data. Physical properties of water. Hydrostatics. Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Pressure gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

DRAINAGE ENGINEERING (CE-21)—Design, construction, operation and maintenance of drainage systems.

Collection of General Data—Development of land drainage. Qualifications and opportunities of the drainage engineer. Preliminary surveys and estimates. Run-off from underdrained areas. Run-off from large areas.

Open Drainage—Soil drainage by open channels. Flow in open channels. Location and construction of ditches and the problems connected therewith.

Under-Drainage—Location and construction of under-drains. Flow in under-drains. Proper size of tile drains.

Special Drainage Problems—Organization of drainage districts and their operation. Design, construction and maintenance of levee drainage systems. Reclamation of tidal lands. Drainage of irrigated lands. Drainage of muck and peat lands. Control of hill waters. Drainage of home surroundings. Cost estimates of drainage construction, operation and maintenance.

Course Thoroughly Practical—"Best Yet"

I must say I think your course by far the best yet; the textbooks can't be beat, which certainly reflects a great deal of credit on some one, and the equipment is good, wonderfully good. I wish I had the complete outfit and library here now for use in my work. The course is thoroughly practical and I have derived a great deal of benefit from it so far and expect to derive a great deal more in the near future.

—B. F. DONKIN, 73 Spring St., Amherst, N. S., Canada.

Irrigation Engineering

(CE-23x)

Irrigation and drainage engineering combined might be termed reclamation engineering. Both aim at the restoration of waste land for productive purposes and offer similar opportunities to engineers situated in regions having characteristics which require in one case drainage, and in the other case watering. Due to their opposite character, they cannot, in most instances, be combined in the practice of one engineer, though drainage is also important in irrigation work. The course deals with the engineering, rather than the agricultural aspects of irrigation, and with stream flow, storage, canals, pipe lines, dams, and other structures required on irrigation projects. It is intended for the man who desires to become connected with the work of reclaiming arid and semi-arid lands, or the management of irrigation systems after construction. It offers an opportunity for advancement to those who are now occupying minor positions in this work.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Shop and construction detail. Drawings for wood, steel, concrete and other materials in civil engineering structures. Foundation plans. Topographical maps. Highway and railroad maps. City plats. Profiles. Cross sections.

PLANE SURVEYING (CE-3)—Preliminary conceptions and definitions. Description, adjustment and the use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined plane. Rotary motion and centrifugal force.

MECHANICS OF MATERIALS (CE-12)—Elastic limit and ultimate strength of structural materials. Elastic and ultimate formation. Properties of materials of engineering. Discussion of simple stress. General theory of beams. Overhanging and fixed beams. Columns and struts. Torsion of shafts. Apparent combined stresses. Resilience of work. Impact. Fatigue of metals.

HYDRAULICS (CE-18)—Fundamental data. Physical properties of water. Hydrostatics. Pressure of water. Theoretical hydraulics. Characteristics of jets. Hook gauges. Pressure gauges. Water meters. Current meters. The Pitot tube. Flow of water through orifices, over weirs of various types, through tubes and pipes, in conduits, sewers, ditches and canals. Dynamic pressure of water. Water hammer. Study of Francis', Bazin's, Kutter's and other hydraulic formulas.

IRRIGATION ENGINEERING (CE-22)—Design, construction, operation and maintenance of irrigation projects.

Preliminary Conceptions—General features of irrigation. Its history. Work of the United States Reclamation Service. Legal considerations and its importance as a social factor.

Hydrology of Irrigation—Rainfall. Evaporation. Seepage. Stream flow. Water storage. Floods and droughts. Hydraulics as applied to irrigation.

Application of Water to Land—Water required for plant growth. Harmful effects of excessive irrigation. Water logging of the soil. Mosquitoes and malarial effects. Danger from alkali water. Irrigation by flooding. Irrigation by furrowing.

Works for Irrigation—Classification and description. Study of the various forms of canals. Slope and alignment of canals. Head works. Sluice ways and regulators. Distributing tubes and pipes. Dams, reservoirs, and weirs. Pumps and pumping. Operation of irrigation systems.

"Happy is the man that findeth wisdom, and the man that getteth understanding, for the merchandise of it is better than the merchandise of silver, and the gain thereof than fine gold."—Prov. 3:13-18.

Hydraulics

(CE-19x)

Hydraulics, as its name implies, is the groundwork of the hydraulic engineering subjects, such as water supply, sewerage, drainage and irrigation. Aside from many practical applications of its own, it is absolutely essential for those wishing to study any of the subjects mentioned. Those dealing with the flow of water in pipes and conduits, or who have to do with pumps and other hydraulic machinery, will find this an excellent course.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and the laws of friction. Kinetics. Uniform and accelerated motion. Laws of falling bodies. Work. Power. Efficiency. Potential and kinetic energy. Heat. The inclined plane. Rotary motion and centrifugal force.

HYDRAULICS (CE-18)—General discussion of the properties and action of liquids.

Fundamental Data—Units of measure. Physical properties of water. Acceleration of gravity as applied to hydraulics. Arrangement of computations.

Hydrostatics—Transmission of pressure. Head and pressure. Loss of weight in water. Depth of flotation. Normal and oblique pressure. Center of pressure. Pressure on gates and dams.

Theoretical Hydraulics—Laws of falling bodies. Flow from orifices. Flow under pressure. Velocity of approach. Energy, impulse, reaction and path of jets. Absolute and relative velocities. Theoretic discharge. Steady flow in smooth pipes and emptying of vessels.

Instruments and Observations—The hook gauge. Pressure gauges. Water meters. Measurement of mean velocity and discharge. Current meters. The Pitot tube. Discussion of observations.

Flow of Water—Coefficients of velocity and discharge. Submerged orifices under varying heads. Standard weirs—with and without end contractions. Francis' formula. Dams. Flow through tubes. Loss of head under various conditions. Flow in pipes. Losses due to curvature. Computation of size of pipes and conduits. Hydraulic gradient. Formulas for flow in pipes. Flow in conduits of various shapes and under varying conditions. Kutter's formula. Sewers. Ditches and canals. Bazin's formula. Variation of velocities in the cross-sections of streams. Dynamic pressure of water, experiments on impulse and reaction. Pressure on surfaces at rest or immersed bodies, on curved pipes and channels. Water hammer in pipes.

Engineering Contracts and Specifications

(CE-4x)

Preparation of contracts and specifications is an important part of the duties of the engineer. This phase of engineering training is too frequently neglected or entirely overlooked. No engineer should consider his knowledge—his stock in trade—as wholly complete or even practically so without a thorough understanding of the business principles to be observed in drawing a binding set of specifications and a workable contract for construction work.

Our course is designed for men who desire a practical knowledge of this subject to round out their training as indicated above.

Subjects Covered in This Course:

BUSINESS LAW (Co-1)—Formation of contracts. Competent parties. Operation and discharge of contracts. Discharge in bankruptcy. Contracts concerning goods. Sales of goods. Duties of seller. Duties of buyer. Bailment of goods. Contracts concerning credits. Negotiable instruments. Conduct of business through representatives. Property in land and movables. Real property. Personal property.

ENGINEERING CONTRACTS AND SPECIFICATIONS (CE-2)—Proper coordination of specifications. Contracts, bonds and other contractual arrangements.

Contract and Bond—Definitions, contract essentials. Surety bonds. Advertisements for bidders. Information for bidders. Form of proposals.

Specifications—General clauses—the proper wording. Considerations of fairness. Plans. Duties of the construction engineer. Duties of the contractor and his workmen. Progress of the work. Specific clauses. Arrangement of clauses and application to the special engineering problem being specified.

MECHANICAL



GEORGE B. PRESTON

FOR the men who are prepared, there is an era of prosperity just ahead. It will mean increased incomes and opportunities to the men of vision. This industrial improvement which is even now apparent in a great many enterprises, will create a demand for trained men who have been prepared by experience and education. You can take a place in this coming period of prosperity by getting the right education.

With the growth in the mechanical production of manufactured articles the demand for trained men has increased in proportion. The supply of men capable of directing production and keeping it up to its highest point of efficiency comes far from satisfying the demand.

A Y.M.C.A. course in Mechanical Engineering or one of its allied subjects will fully qualify you to direct the work of others efficiently. Your latent ability and constructive ideas can then be utilized to the fullest degree. Your success in gaining quick advancement and increased pay will surely follow.

Earnings in the Mechanical Field

As to salaries, a first-class mechanical engineer can today obtain from $2,500 to $8,000 a year, and sometimes more. The higher salaried positions, however, require executive ability. Skilled machinists and tool makers, pattern makers, blacksmiths and moulders, are paid $5 to $10 a day, with time and a half or double time for over-time. A foreman or superintendent, having taken a course in Advanced Machine Shop Practice and Machine Shop Management, may receive $2,500 to $5,000 a year. Skilled draftsmen with ability to design get $150 to $225 a month. Factory managers receive $4,000 or more a year. Men qualified in all branches of steam engineering get $3,000 to $6,000. Refrigerating engineers, $2,500 to $4,500. Master plumbers, $8 to $12 a day.

Teachers of Experience to Guide You

The head of the Mechanical Engineering Department is George B. Preston, M.M.E., a graduate of Cornell University and formerly a member of the faculty of Mechanical Engineering at Columbia University. In addition to his teaching experience, Mr. Preston has been engaged in mechanical engineering practice for fifteen years. Mr. Preston is ably assisted by Professor C. C. Sleffel, formerly assistant professor of Industrial Arts at Teachers College and now assistant professor of Mechanical Engineering, Columbia University. These two masters of mechanical studies are ably assisted in their work by a corps of experienced instructors and examiners who give their most careful personal attention to every lesson sent in by the student. They are always ready to assist students in solving practical problems and their help and advice have proved invaluable to many men who have studied under their direction and shared in their wealth of experience.



C. C. SLEFFEL

Mechanical Engineering

(ME-20x)

This course is planned for the practical man in any position from apprentice to manager, who desires to prepare for advancement by obtaining a thorough knowledge of the fundamental principles of the theory and practice of mechanical engineering.

The course is also well adapted to fill the needs of the man whose college course in mechanical engineering has been interrupted and who wishes to complete his education.

It is a most complete and comprehensive course, covering all phases of mechanical engineering. Nothing is omitted that will serve to fit the student to fill practical positions of large responsibility. A study of the content of the course as outlined below should be convincing proof of its thoroughness.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphical methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING(Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

USE OF THE SLIDE RULE (CE-1)—Mechanical multiplication and division. Roots, powers. Representation of logarithms on the scales of the rule. Setting the rule to perform various arithmetical calculations. Locating the decimal point. How to perform a series of operations on the rule.

***SOLID GEOMETRY** (Ma-15)—Fundamental propositions which have to do with solids of various shapes. Problems of practical value to the engineer.

***ANALYTICAL GEOMETRY** (Ma-7)—Comprehensive treatment of the relation between the equation and the graph. Helpful in the field of engineering. Prerequisite for the calculus.

***CALCULUS** (Ma-8)—A simple and direct treatment of both branches of the calculus applied to problems in dynamics; physics; and mechanical, electrical, and civil engineering. Many interesting problems discussed.

***COST ACCOUNTING** (Co-4)—Principles. Methods. Indirect expense accounts. Stores accounting and records. Labor costs. Time and pay records. Indirect expense. Fixed charges. Expense distribution. Representative cost systems. Graphic presentation of cost data. Use of charts. Forms.

Particularly valuable in connection with Factory Management and Industrial Efficiency (ME-10), or with Foremanship (ME-11).

MACHINE WORKING DRAWING (Dr-46)—Working drawings of complex machine details. Study of dimensioning as related to drawing room, pattern shop, machine shop. Assembly drawings from details. Study of such considerations as scales, proper methods of representation, interference and checking dimensions. Methods of procedure in assembling. Assembly and general shop notes.

PHYSICS (Ac-26)—Simple and direct instruction dealing with transfer of energy and properties of matter. Heat and light. Electricity and magnetism.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Laws of sines. Parallel forces. Center of gravity. Moment of inertia. Laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

DESCRIPTIVE GEOMETRY (Dr-52)—Principles of projection. Manipulation of planes and traces. Practice in the use and making of plates.

MECHANICS OF MATERIALS (CE-12)—Strength of materials. Deformation. Elastic change of length. Properties of materials of engineering. Beams. Theory of beams. Reactions. Vertical shear. Bending moment. Internal and external forces. Safe loads. Column formulas. Combined stresses. Axial shear. Horizontal shear. Resilience and work. Impact. Fatigue of materials. Torsion of shafts.

MACHINE DRAWING (Dr-9)—Working drawings of machinery. Special attention to the detail of machinery. Assembly drawings. Calculations required in connection with the design of machines. Plates include machine drawings. Thorough attention is given to various machine details.

MACHINE SHOP TOOLS AND METHODS (ME-14)—Measuring instruments, micrometer calipers, limit gauges, hand tools and their use. Comprehensive treatment of en-

**Optional.* (*See Page* 12.)

gine lathe, and its various uses. Special lathes, turret lathes, gap lathe, screw cutting machines. Shapers. Slotters. Milling machines. Boring and drilling machines. Gear cutting machines. Key seating machines. Emery wheels. Grinding machines. Cutting tools. Speeds and feeds. Speeds and feeds for grinding.

BLACKSMITHING AND FORGING (ME-12)—Tools and equipment. Welding. Calculation of stock. Upsetting. Drawing out and bending.

Steam Hammer Work—Auxiliary tools. Forming dies. Drop forging.

Tool Forging and Tempering—Miscellaneous forging operations, brazing, shrinking. Pipe bending.

Heat Treatment of Steel—Various forms of hardening baths, tempering, case hardening. High-speed steel and its manipulation.

CHEMISTRY (Ac-17)—Fundamental principles and applications of chemistry necessary for the engineer. Chemical elements. Principles and laws. Nomenclature. Equations. Acids and bases. Methods of recording scientific observations.

FOUNDRY PRACTICE (ME-13)—Methods of molding. Working with green sand, dry sand, and loam. Methods of molding as applied to steel, brass, bronze, malleable and chilled iron. Stresses due to contracting in molding. Molding machines. Die casting. Special problems in founding.

MECHANISM (Dr-13)—Fundamental ideas in regard to mechanism. Various methods for applying forces. Various linkages with considerations in regard to their design and application.

STEAM ENGINES AND TURBINES (ME-3)—Fundamental principles. Work and power. Steam engines. Indicator diagrams. Mean effective pressure. Indicated horse power. Brake horse power.

Energy—Heat. Unit of heat. Mechanical equivalent of heat. Calorimeters. Generation of heat. Effect of heat on gases. Laws of gases. Properties of steam. Condensation and evaporation.

Heat, Work and Pressure—Properties of steam. Use of the steam tables. Indicator diagrams. The planimeter. The entropy diagram. Thermal efficiency.

The Steam Engine—Elementary principles. Classification of engines. Detailed consideration of the various parts of steam engine—slide valve, valve setting, eccentrics, reversing mechanisms, valve gears, governors, compound engines, condensing apparatus. Cooling ponds and towers.

Turbines—Temperature entropy diagrams as applied to superheated steam. Flow of steam. Characteristic types of turbines. Details of turbine construction. Nozzles and blades and the action of steam in them. Graphical solutions of problems in turbine design. Mechanical losses in turbines. Thermal losses in turbines. Commercial types of turbines. Problems in governing steam turbines. Various commercial types of governors. Transmission. Testing. Design. Problems involving strength of materials.

MACHINE DESIGN (Dr-8)—Fundamental principles of design. Designing and drawing machine details. The design of couplings, bearings, journals, gears, frames and bed plates. Steam engine details. Steam engine design.

STEAM BOILERS, SUPERHEATERS AND ECONOMIZERS (ME-4)—General considerations. Fuels and combustion. Selection and purchase of coal. Powdered coal. Hand firing. Various types of mechanical stokers. Auxiliary apparatus for handling coal.

Oil—Oil burning furnaces. Theoretical and practical considerations in regard to oil transportation and storage. Fundamentals of combustion. Calorific value of oil. Gas and its application to the steam boiler. Theory of combustion. Products of combustion. Heat losses. Heat balance. Testing.

Steam Boilers—Discussion of various types of boilers—vertical tube, fire box, Scotch marine, horizontal return tubular. Babcock & Wilcox, Heine, Parker, Wickes, Stirling, Winslow, and others. Detailed study of the steam boiler, touching upon heating surfaces, horse power, grate surfaces, rate of combustion, boiler efficiency, grate efficiency, boiler capacity, grate settings, boiler auxiliaries.

Superheaters—Advantages of superheating. Types of superheaters. Limits of superheating. Theoretical considerations. Various commercial types of superheaters.

Economizers—Choice of feed water heating systems. Factors determining installation of economizers. Value of economizers. Feed water heaters. Temperature rise in economizers.

Other Auxiliaries—Pumps. Condensers. Piping. Feed water purification systems.

Installation—Cost of power. Typical specifications. Typical central stations. Isolated stations. Characteristic load curves for various operating conditions.

STEAM—Miscellaneous Applications (ME-18)—Heat losses from buildings. Types of heating systems. Types of installations. Calculation of sizes of installations. Heating contracts. Evaporating. Distilling. Digesting.

HYDRAULICS (CE-18)—General discussion of the properties of liquids.

Hydrostatics—Transmission of pressure. Effect of head upon pressure. Flotation. Pressure on gates and dams.

Theoretical Hydraulics—Laws of falling bodies. Flow from orifices and through pipes. Weirs and their application in determining the flow of water. Hydraulic gradient. Measuring instruments and their application.

APPLIED ELECTRICITY FOR PRACTICAL MEN (EE-7)—Current. Resistance. Electromotive force. Magnetism. Direct current generators, parts and windings. Heating and power. D. C. motors and controllers. Resistance. Alternating currents. Transformers. Polyphase principles. Alternators. A. C. motors. Controllers. Synchronous converter. A.C. and D.C. motor troubles. Storage batteries. Illumination. Lamps, reflectors. Wiring.

NOTE: In addition to the subjects already listed one only of the following subjects is required to complete the Mechanical Engineering Course. If others are desired they may be had at an additional cost. Price on application.

FUELS AND FUEL ECONOMY (ME-1)—**Heat Energy**—How it is expressed. Heat transfer in boilers. Radiation. Conduction. Convection. Boiler circulation. Steam formation. Characteristics of steam.

Fuels—Wood. Peat. Lignite. Anthracite coal. Bituminous coal. Pulverized coal. Fuel oil. Gas. Heat values. Proximate analysis. Ultimate analysis. Purchase of fuels.

Drafts—Draft loss. Value of chimneys. Forced draft. Use of fan. Induced draft.

Firing Methods—Burning hard coal. Burning

soft coal. Firing efficiency. Overfeed stokers. Underfeed stokers. Chain grate stokers. Hand stokers.

Furnaces—Furnaces for metallurgical and other manufacturing purposes. Furnace efficiency. Control apparatus for furnace operation.

ENGINE ROOM METHODS (ME-2)—Heat, work and pressure. Properties of steam. Formation of steam. Superheated steam. The indicator. Ratio of expansion. Mean effective pressure. Principles of the steam engine. Automatic high-speed engines. Corliss, cross compound, tandem compound. Locomobile and uniflow engines. Action of steam in cylinder. Steam engine testing. Slide valves. Poppet valves. Valve setting. Operation and maintenance. Condensers. Forms of condensing apparatus.

Gears—Meyer valve gear. Stephenson link motion. Walschaert valve gear. Corliss valve gear.

Governors—Pendulum governors. Shaft governors. Inertia governors. Centrifugal governors.

Lubrication—Friction. Characteristics of oil. Testing oils. Lubricating systems.

Turbines—General principles. Types of turbines. Operation and maintenance.

GAS AND OIL ENGINE OPERATION (ME-6)—This subject is designed to meet the needs of operating engineers who wish to increase their knowledge of the principles and methods involved in the operation of stationary gas and oil engines, enabling them to qualify as chief engineers of power plants equipped with these engines. Among the topics covered are: Sources of power. Laws of gases. Heat energy. Carnot's cycle. Gas engine cycles. Combustion. Carburetion. Ignition. Governing. Cooling. Brake horse power. Indicated horse power. Cylinders. Speeds. Efficiency. Scavenging. Engine operation and maintenance. Repairs.

REFRIGERATION (ME-7)—The extraction of heat. Heat liberated or absorbed when matter changes its state. Refrigeration by evaporation of liquids. Thorough consideration of such systems as compression, absorption, brine circulating, and congealing tank. Compressors, generators, absorbers, exchangers, analyzers, condensers, piping, tanks. Ice-making systems—can system, plate system, center-freeze system. Distilling apparatus. Miscellaneous auxiliaries. Design and construction of cold storage plants.

PLUMBING (ME-8)—Plumbing tools. Plumbing materials. Joints and connections. Use of soldering iron, gas furnace, and gasoline torch. Wiped joints. Work with tile pipes. Work with cast-iron pipes. Work with screwed pipes. Design of house drainage systems. Sewer systems. Sewerage disposal. Hydromechanics. Direct and indirect water supply systems. Hot water supply. House heating by warm air, steam and hot water.

TRACTORS AND FARM MACHINERY (RE-4)—Sources of power. Internal combustion engines. Steam engines and boilers. Steam and gas tractors. Stationary gasoline and kerosene engines.

FACTORY MANAGEMENT AND INDUSTRIAL EFFICIENCY (ME-10)—Course for mechanics, foremen, superintendents, and managers who desire to make themselves more valuable. It will increase their knowledge of the most efficient modern production methods, including handling of materials. It discusses exhaustively the best methods of handling men. It considers the various departmental relationships, purchasing of materials, various wage systems and accounting.

FOREMANSHIP (ME-11)—The foreman's place in industry. Methods of getting production. Departmental relationships. Developing interest. Materials and their handling. Working machinery to capacity. Team work. Safeguarding the worker. Principles of organization. Systems of wage payment. Art of management.

MACHINE SHOP MANAGEMENT (ME-23)—Shop organizations and their characteristics in regard to management. Apprenticeship training. Function of drafting room. Personal effectiveness. Standardization of machine units. Tool room methods. Production systems. Inspection systems. Purchasing methods. Inventories. Routing. Dispatching. Planning. Time and cost keeping. Rate setting. Profit sharing and bonus systems.

ADVANCED MACHINE SHOP PRACTICE (ME-24)—Standard machines, tools, and attachments. Cutting feeds and speeds. Cutting tool angles and clearances. Low-swing lathes. Multiple turning. Relieving attachments. Thread cutting. Turret lathe practice. Hollow milling tools. Gear cutting. Boring mills. Drilling practice and jig design. Radial drills. Principles of jig design. Grinding processes. Magnetic chucks. Planing mills. Universal milling machines. Angular indexing. Die sinking machines.

PATTERNMAKING (ME-16)—Properties and uses of the principal varieties of timber. Defects in timber. Seasoning. Effects of shrinkage. Preservation of timber. Patterns and their relation to molding. Skeleton patterns. Split patterns. Solid patterns. Equipment for patternmaking.

TOOL DRAFTING AND DESIGN (Dr-7)—Standard and special tools. Design of turning tools. Turning tools for the turret lathe. Boring tools. Boring bars. Recessing tools. Arbors for turning, boring and grinding. Chucks. Taper boring and turning attachments. Jigs and fixtures. Practical considerations in regard to detailing emphasized throughout.

PUNCH AND DIE DRAFTING AND DESIGN (Dr-14)—Fundamental principles. Press tools in general. Blanking dies. Piercing tools. Compound dies for blanking and piercing. Parting tools. Shaving dies. Trimming dies. Drawing dies. Combination dies. Bending and forming tools. Dies for embossing and marking, riveting and swaging. Indexing and transfer dies. Punch and die standards. Methods for hardening dies. Design of punches and dies.

SHEET METAL DESIGN (Dr-39)—Tinsmithing. Sheet metal work. Skylight work. Roofing. Cornice work.

ELECTRICAL EQUIPMENT OF THE AUTOMOBILE (EE-9)—Fundamental principles. Magnetos. Batteries. Motors. Generators. Spark plugs. Starting and lighting systems. Wiring diagrams. Charging equipment. Electrical accessories. Testing.

AUTOMOBILE CONSTRUCTION AND REPAIR (ME-20)—Locating trouble, adjusting, and making repairs of automobile and truck engines. Carburetors. Fuel supply. Cooling and lubrication systems. Clutches. Transmissions. Steering apparatus. Wheels. Brakes. Springs. Shop equipment for repairing automobiles and trucks.

Machine Shop Tools and Methods

(ME-16x)

Every man employed in the building, operation or repair of machinery will find in this course a short cut to advancement. Not only does it give a thorough explanation of the standard tools and their varied uses in the machine shop, but it trains the student to sketch, draw or illustrate machines or repairs to them.

Completion of the course will give the student a practical, comprehensive knowledge of machine shop tools and methods that will insure a better job and bigger pay.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Free-hand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-21) Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop.

MECHANICAL WORKING DRAWING (Dr-47) Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

MACHINE SHOP TOOLS AND METHODS (ME-14)—Measuring instruments, micrometer calipers, limit gauges, hand tools and their use. Comprehensive treatment of engine lathe, and its various uses. Special lathes. Turret lathes, gap lathe, screw cutting machine. Shapers. Slotters. Milling machines. Boring and drilling machines. Gear cutting machines. Key seating machines. Emery wheels. Grinding machines. Cutting tools. Speeds and feeds. Speeds and feeds for grinding.

MACHINE SKETCHING (Dr-48)—Training in the sketching of machine parts. Sketches of machine details, sections and assemblies. Assembly sketches from machine details.

Advanced Machine Shop Practice

(ME-24x)

A course for the advanced apprentice or for the machinist who wishes to become fully informed with regard to modern machine tools. It should be undertaken by men who are familiar with the standard machine tools and have a working knowledge of the simpler machine shop operations. It will increase their knowledge of standard and special machines. A man who has completed this course should qualify as a first-class machinist or foreman.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

ADVANCED MACHINE SHOP PRACTICE (ME-24)—Standard machines, tools, and attachments. Cutting feeds and speeds. Cutting tool angles and clearances. Low-swing lathes. Multiple turning. Relieving attachments. Thread cutting. Turret lathe practice. Hollow milling tools. Gear cutting. Boring mills. Drilling practice and jig design. Radial drills. Principles of jig design. Grinding processes. Magnetic chucks. Planing mills. Universal milling machines. Angular indexing. Die sinking machines.

MACHINE SKETCHING (Dr-48)—Training in the sketching of machine parts. Sketches of machine details, sections and assemblies. Assembly sketches from machine details.

Courses Are Up to College Standard—

These Y.M.C.A. Home Study Courses are wonderful. The texts are the most practical and complete books I have ever seen. From what I have learned of engineering courses during my two years at College, I am convinced, as far as instruction goes, that these courses are up to college standard. No student can help feeling the influence of service which lies back of the whole Y.M.C.A. organization. —ARLO R. LAUGEE, 26 Avery St., Laconia, N. H.

Machine Shop Management

(ME-25x)

This is a course for men who desire to qualify for positions in shops and factories as superintendents or managers, and who wish to become fully acquainted with modern methods of production. It includes the selection of equipment, the laying out of shops for particular operations, and the most efficient methods of handling work through the shops. It deals with the principles upon which the best work can be obtained from shop workers.

Topics Covered in This Course:

MACHINE SHOP MANAGEMENT (ME-23)—Shop organizations and their characteristics in regard to management. Apprenticeship training. Function of drafting room. Personal effectiveness. Standardization of machine units. Tool-room methods. Production systems. Inspection systems. Purchasing methods. Inventories. Routing. Dispatching. Planning. Time and cost keeping. Rate setting. Profit sharing and bonus systems.

Advanced Machine Shop Practice and Machine Shop Management

(ME-15x)

A course for the machinist, foreman or superintendent who wishes to prepare for advancement by increasing his knowledge of up-to-date machine tools, their capabilities and methods of use. For the man who wishes to become thoroughly familiar with the most efficient methods of machine shop management, including systems of planning, routing, and inspecting work. Problems regarding personnel. Selecting and laying out equipment.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

ADVANCED MACHINE SHOP PRACTICE (ME-24)—Standard machines, tools, and attachments. Cutting feeds and speeds. Cutting tool angles and clearances. Low-swing lathes. Multiple turning. Relieving attachments. Thread cutting. Turret lathe practice. Hollow milling tools. Gear cutting. Boring mills. Drilling practice and jig design. Radial drills. Principles of jig design. Grinding processes. Magnetic chucks. Planing mills. Universal milling machines. Angular indexing. Die sinking machines.

MACHINE SKETCHING (Dr-48)—Training in the sketching of machine parts. Sketches of machine details, sections and assemblies. Assembly sketches from machine details.

MACHINE SHOP MANAGEMENT (ME-23)—Shop organizations and their characteristics in regard to management. Apprenticeship training. Function of drafting room. Personal effectiveness. Standardization of machine units. Toolroom methods. Production systems. Inspection systems. Purchasing methods. Inventories. Routing. Dispatching. Planning. Time and cost keeping. Rate setting. Profit sharing and bonus systems.

Advance Shop Practice and Management Course Expresses Every Detail Necessary

As a student of the United Y.M.C.A. Schools, I wish to say that the Correspondence Instruction that I have received from your course has helped me more than any of the three other correspondence courses I have taken. The system expressed every detail necessary; also when any additional information is required, your service is very efficient.

I feel justified in recommending any of the courses, as I am sure, if the instructions are followed carefully, other students will benefit from your courses as I have.

—CHARLES A. WATKINS, 28 Temple Street, Nashua, N. H.

His Mechanical Engineering Course a Splendid Investment

My Course in Mechanical Engineering is proving a splendid investment. I am gaining a great deal of valuable knowledge from it which is very beneficial in my daily work.

—RAYMOND P. ARLT, W. Crescent Ave., Allendale, N. J.

Foremanship

(ME-18x)

Prepare yourself for the job ahead of you. If you are employed in factory work and are looking for advancement, you should study this course.

For foremen this training is of especial value. The most vital link in the chain of an organization is the foreman—he is the point of contact between worker and executive. If he knows how to get results in production, understands broader policies of operation, knows how to manage subordinates—in short, if he knows how to manage efficiently, he is on his way to advancement.

Topics Covered in This Course:

FOREMANSHIP (ME-11)—The Foreman and His Job—Foreman's place in industry. Basic factors in production. Departmental relationship. Foreman and management. Foreman and production. Foreman and social order.

Materials and Their Handling—Gathering and issuing materials. Man and the material. Movement of materials. Care of materials. Fabricating materials. Developing interest. Workmanship and originality. System and the worker.

Equipment and Machinery—General factory equipment. Working machinery to capacity. Keeping equipment in working order. Providing machinery with work. Working conditions. Team work. Man and the machine. Safeguarding the worker.

Organization and Management—Principles of organization. Labor turnover. Systems of payment for labor. Making the organization effective. Art of management. Knowing men. Developing men. Leadership.

Factory Management and Industrial Efficiency

(ME-8x)

Keen competition has brought about much standardization of factory production and operation methods. Industrial concerns throughout the country are constantly on the lookout for men capable of reducing production costs. Men who can efficiently direct the operation and production side of an industrial plant command attractive salaries. The position is very favorable to quick advancement, limited only by the manager's own ability.

The instruction covers thoroughly the problems that confront the executive in entire charge of labor, the production costs that are so vital to the success of a factory, and the most modern methods of factory management.

Subjects Covered in This Course:

FACTORY MANAGEMENT AND INDUSTRIAL EFFICIENCY (ME-10)—Forms of industrial organization and systems of management. Records of costs and manufacturing conditions. Function of tool service department. Ordering, manufacturing, distributing and accounting systems for special tools. Following progress of work in manufacturing department. Inspection system for machine shops. Storage and maintenance for small tools. Methods of delivering and identifying tools. Organization of an assembly department. System of purchasing department.

Wage Systems—Piece work, premium, and bonus systems.

Drafting Room Systems.

Bookkeeping and Accounting Systems—Factory cost accounting. Labor and manufacturing expense. Factory accounting practice. Vouchers. Forms. Statements. Indirect-expense. Depreciation. Expense distribution. Machine hour rates. Process cost system. Use of graphic charts.

COST ACCOUNTING (Co-4) — Principles. Methods. Indirect expense accounts. Stores accounting and records. Costs. Time and pay records. Indirect expense. Fixed charges. Expense distribution. Representative cost systems. Graphic presentation of cost data. Use of charts. Forms.

FOREMANSHIP (ME-11)—The foreman's place in industry. Methods of getting production. Departmental relationships. Developing interest. Materials and their handling. Working machinery to capacity. Team work. Safeguarding the worker. Principles of organization. Systems of wage payment. Art of management.

Blacksmithing and Forging

(ME-19x)

A thoroughly up-to-date, practical course. It will qualify the blacksmith, forge-shop man, or foreman for advancement. It deals with the best methods of working hot metals, gives thorough instruction in laying out of work, and takes up in detail the modern machinery used in production of forgings.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.
All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-21) Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assembles. Making assembly drawings from details.

BLACKSMITHING AND FORGING (ME-12)—Tools and equipment. Welding. Calculation of stock. Upsetting. Drawing out and bending.

Steam Hammer Work—Auxiliary tools. Forming dies. Drop forging.

Tool Forging and Tempering—Miscellaneous forging operations, brazing, shrinking. Pipe bending.

Heat Treatment of Steel—Various forms of hardening baths, tempering, case hardening. High-speed steel and its manipulation.

Patternmaking

(ME-14x)

Patterns as they are made today in the modern pattern shop. Practical and comprehensive enough for the experienced man. Simple enough for the young man who hopes to become an expert workman or to assume a position of responsibility in the pattern shop. It deals with the construction of the various types of patterns, discusses moulding and its effect on the work of the patternmaker, and considers the durability and consequent cost of a pattern in relation to its future use. The machinery of the pattern shop, its care and operation.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.
All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensions of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

PATTERNMAKING (ME-16)—Properties and uses of the principal varieties of timber. Defects in timber. Seasoning. Effects of shrinkages. Preservation of timber. Patterns and their relation to molding. Skeleton patterns. Split patterns. Solid patterns. Conditions of cost and durability. Equipment for pattern making.

MACHINE SKETCHING (Dr-48)—Training in the sketching of machine parts. Sketches of machine details, sections and assemblies. Assembly sketches from machine details.

Foundry Practice

(ME-17x)

Metal casting has been practised since early Babylonian days. It is one of the oldest arts of which we have any record. Foundry operations are simple in principle, but for one desiring to make this more than just mere "work," it is necessary that he have a knowledge of metals, heat, sand moulding machines, etc. This course provides a most practical and comprehensive treatment of the subjects here listed.

Subjects Covered in This Course:

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

FOUNDRY PRACTICE (ME-13)—Methods of molding. Working with green sand, dry sand, and loam. Methods of molding as applied to steel, brass, bronze, malleable and chilled iron. Stresses due to contracting in molding. Molding machines. Die casting. Special problems in founding.

Plumbing

(ME-10x)

Master plumbers are much in demand. There are few trades that offer as good an opportunity for a man to get into business for himself. The earnings are above the average, and the man who has a thorough knowledge of the trade is sure to be well paid. This is a practical course for plumbers, apprentices, or any one desiring to qualify as a journeyman or master plumber. It includes detailed instructions in making joints, installing plumbing fixtures, determining sizes of pipe and fixtures, preparing plumbing plans and specifications, installing house heating systems.

Subjects Covered in This Course:

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by means of views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications. Bills of materials.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

PLUMBING (ME-8)—Plumbing tools. Plumbing materials. Joints and connections. Use of soldering iron, gas furnace, and gasoline torch. Wiped joints. Work with tile pipes. Work with cast iron pipes. Work with screwed pipes. Design of house drainage systems. Sewer systems. Sewerage disposal. Hydromechanics. Direct and indirect water supply systems. Hot water supply. House heating by warm air, steam and hot water.

READING OF HEATING AND PLUMBING PLANS (ME-28)—Lessons and blueprints. Heating and plumbing symbols. Heating and plumbing plans for small houses, large houses, apartment houses and office buildings. Student is required to make complete heating and plumbing layouts for an entire building from plans.

Refrigeration

(ME-11x)

Mechanical refrigeration plays an important part in the life of a community to-day. It is upon mechanical refrigeration that we depend largely to keep fresh the eggs, butter, meat and vegetables that come to our table. Various types of refrigeration plants have been developed to deal best with the various food stuffs, taking into account such considerations as the most advantageous temperature, the amount of humidity required, and the absorption of odors from other articles. The artificial ice plant represents still another type of installation. The modern office building requires the attention of the refrigeration engineer.

This course is suitable for all who are engaged in refrigeration or ice-making. It is well adapted for others who wish to familiarize themselves with the broad field of refrigeration. Particularly advantageous for the mechanical engineer desiring to specialize in refrigeration.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

REFRIGERATION (ME-7)—The extraction of heat. Heat liberated or absorbed when matter changes its state. Refrigeration by evaporation of liquids. Thorough consideration of such systems as compression, absorption, brine circulating, and congealing tank. Compressors and generators, absorbers, exchangers, analyzers, condensers, piping, tanks. Ice-making systems—can system, plate system, center-freeze system. Distilling apparatus. Miscellaneous auxiliaries. Design and construction of cold storage plants.

MACHINE SKETCHING (Dr-48)—Training in the sketching of machine parts. Sketches of machine details, sections and assemblies. Assembly sketches from machine details.





G. B. PRESTON

IN the engine room, the boiler room, or the business office, the man with the technically trained mind is in constant demand. Business concerns everywhere are searching for men who can develop the greatest amount of energy from a dollar's worth of fuel. Even though the salaries of power plant operatives and steam engineers are large, the demand for well-trained, educated men keeps well ahead of the supply.

The responsibilities of the steam engineer and power expert are seen by their importance in the economic life of the world. The light we burn, our transportation facilities, the wheels of the factory, the preparation of our food, all require the use of power. Probably eighty per cent. of our power is produced by fuel. It is the motive power of progress in all parts of the world.

Keeping step with the growing demand for fuels, the price of power has become a vital factor in production costs. Thus the steam engineer or power expert holds an important position. His opportunities for rising to a bigger job are made more certain by technical training. Few power men or steam engineers receive less than $3,000 a year; many have incomes of $5,000 and more.

Look around you; note the men working on the same job with you. They are all just as anxious as you to get ahead. There is only one way to rise above your competitors—get more knowledge, then apply it.

Instruction Staff

The head of the Power Department is George B. Preston, M.M.E., a graduate of Cornell University with the degree of Mechanical Engineer. He was called to the teaching staff of his alma mater shortly after graduation, and was given the degree of Master of Mechanical Engineering. Mr. Preston had fifteen years of engineering practice and was for four years a member of the Mechanical Engineering faculty of Columbia University. He is well qualified in practical and teaching experience to conduct the work of this department.

Mr. S. J. Thackaberry, instructor in Stationary Engineering, has had many years' experience in power plants. He is expert as a teacher of this subject and knows how to make clear solutions to problems of the Engine and Boiler Room. Mr. Thackaberry served two years as Chairman of the Educational Committee of the New York State Association of the National Association of Stationary Engineers, and was recently elected president of this organization.



S. J. THACKABERRY

Lieut. Arthur M. Todé, U.S.N.R.F., is the instructor in Marine Engineering. Mr. Tode has served in both the Merchant Marine and the U. S. Navy, in every position on the engine-room staff from oiler to Chief Engineer. His technical education was obtained in the New York State Nautical School, in the U. S. Navy Turbine Engineering Academy, and in marine machinery factories.

Steam Engineering

(ME-2x)

One of the biggest, best paying professions in the industrial fields is Steam Engineering. The huge responsibility of keeping the operating wheels of the business world in motion rests on the ability and experience of the engineer. The importance of his work insures a good and steadily increasing income.

This course goes thoroughly into the engineering problems connected with the generation of steam and its application to the production of power and to manufacturing processes. To every man desiring to prepare himself for power plant superintendent, this course is of special value.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphical methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more graphical problems.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

MECHANICS OF MATERIALS (CE-12)—Strength of materials. Deformation. Elastic change of length. Properties of materials of engineering. Beams. Theory of beams. Reactions. Vertical shear. Bending moment. Internal and external forces. Safe loads. Column formulas. Combined stresses. Axial shear. Horizontal shear. Resilience and work. Impact. Fatigue of materials. Torsion of shafts.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawing from details.

STEAM BOILERS, SUPERHEATERS AND ECONOMIZERS (ME-4)—**General Principles**—Heat. Energy. Work. Power. Mechanical equivalent of heat. Temperature. Absolute zero. Conduction. Convection. Radiation. Insulation. Thermometer. Pyrometers. Expansion due to heat. Specific heat of solids and gases. Laws of gases.

Fuels—Principles of combustion. Flue gas analysis. Solid, liquid, and gaseous fuels. Anthracite and bituminous coal. Powdered coal. Fuel oil. Gas as a fuel.

Steam Boilers—Types of boilers. Heating surfaces. Steam space. Circulation. Baffling. Grates. Water regulators. Water gauges. Fusible plugs. Furnaces. Stokers. Superheaters. Economy due to superheated steam.

Feed Water Heating—Open heaters. Closed heaters. Live steam purifiers and heaters. Economizers. Limitations of economizers. Economizer heating surface.

Boiler Room Operation—Coal storage. Apparatus for boiler control. Economic operation of boilers. Selection of number, size and type of boilers. Number of boilers on line for maximum efficiency.

STEAM, Miscellaneous Applications (ME-18), —Heat losses from buildings. Location and proportioning of radiators. Single-pipe and two-pipe direct heating systems. Indirect heating systems. Exhaust system heating. Vapor systems. Vacuum return. Central station heating. Meters. Traps. Steam distribution. Design of central heating plants. Heating contracts. Evaporating. Distilling. Digesting.

STEAM ENGINES AND TURBINES (ME-3) —Fundamental principles. Work and power. Steam engines. Indicator diagrams. Mean effective pressure. Indicated horse power. Brake horse power.

Energy—Heat. Unit of heat. Mechanical equivalent of heat. Calorimeters. Generation of heat. Effect of heat on gases. Laws of gases. Properties of steam. Condensation and evaporation.

Heat, Work and Pressure—Properties of steam. Use of the steam tables. Indicator diagrams. The planimeter. The entropy diagram. Thermal efficiency.

The Steam Engine—Elementary principles. Classifications of engines. Detailed consideration of the various parts of steam engine —slide valve, valve setting, eccentric, reversing mechanisms, valve gears, governors, compound engines, condensing apparatus. Cooling ponds and towers.

Turbines—Temperature entropy diagrams as applied to superheated steam. Flow of steam. Characteristic types of turbines. Details of turbine construction. Nozzles and blades and the action of steam in them. Graphical solutions of problems in turbine design. Mechanical losses in turbines. Thermal losses in turbines. Commercial types of turbines. Problems in governing steam turbines. Various commercial types of governors. Transmission. Testing. Design. Problems involving strength of materials.

Stationary Engineering

(ME-5x)

Among the thousands of firemen, and assistant and watch engineers, only comparatively few are taking advantage of the present by studying the job of the man higher up. If you are one of these workers and you desire to train yourself for promotion, or to obtain a chief engineer's license, you will be prepared for the opportunity by studying this course.

Every detail of stationary engineering is taught, affording a complete knowledge of fuels, steam generation, and the use of steam for power production. The subject is presented in that clear way so easy to understand, which makes "Y" courses so desirable for home study.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphical methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

FUELS AND FUEL ECONOMY (ME-1)—**Heat energy**—How it is expressed. Heat transfer. Radiation. Conduction. Convection. Boiler circulation. Steam formation. Characteristics of steam.

Fuels—Wood. Peat. Lignite. Anthracite coal. Bituminous coal. Pulverized coal. Fuel oil. Gas. Heat values. Proximate analysis. Ultimate analysis. Purchase of fuels.

Drafts—Draft loss. Value of chimneys. Forced draft. Use of fan. Induced draft.

Firing Methods—Burning hard coal. Burning soft coal. Dampers. Firing efficiency. Overfeed stokers. Underfeed stokers. Chain-grate stokers. Hand stokers.

Furnaces—Furnace for metallurgical and other manufacturing purposes. Furnace efficiency. Control apparatus for furnace operation.

BOILER ROOM METHODS (ME-17)—**Construction.** Strength of boilers. Boiler settings and connections. Steam, water, and blow-off piping. Safety valves. Gauges. Water columns. Safety plugs. Superheaters. Pumps and injectors. Economizers and feed water heaters.

Feed Water—Scale. Corrosion. Foaming. Priming. Treatment of feed water.

Operation—Inspection and care of boilers, attachments, and auxiliaries. Boiler testing. Instruments. Regulators for economical operation. Number of boilers steaming from standpoint of economy.

ENGINE ROOM METHODS (ME-2)—Heat, work and pressure. Properties of steam. Formation of steam. Superheated steam. The indicator. Ratio of expansion. Mean effective pressure. Principles of the steam engine. Automatic high-speed engines. Corliss, cross-compound, tandem-compound, locomobile, and uniflow engines. Action of steam in cylinder. Steam engine testing. Slide valves. Poppet valves. Valve setting. Operation and maintenance. Condensers. Cooling ponds and towers.

Gears—Meyer valve gear. Stephenson link motion. Walschaert valve gear. Corliss valve gear.

Governors—Pendulum governors. Shaft governors. Inertia governors. Centrifugal governors.

Lubrication—Friction. Characteristics of oil. Testing oils. Lubricating systems.

Turbines—General principles. Types of turbines. Operation and maintenance.

APPLIED ELECTRICITY FOR PRACTICAL MEN (EE-7)—Fundamental principles. Current. Resistance. Electro-motive force. Magnetism. Direct current generators, parts and windings. Heating and power. D. C. motors and controllers. Alternating current. Transformers. Polyphase principles. Alternators. A. C. motors. Controllers. Synchronous converter. A. C. and D. C. motor troubles. Storage batteries. Illumination principles. Wire and wiring.

Marine Engineering

(ME-13x)

Over ten million tons of shipping keep the American flag on the seas. Men with the knowledge of marine engineering are in demand. The marine fireman, or assistant engineer, will find his opportunity to gain advancement through the study of this course. It covers every point of marine engineering. Also it fills the needs of the man who wishes to pass the examination for Marine Engineer's license of the highest grade.

"The world is demanding as never before, men of good character with well-developed minds. Train your mind and get into the executive class where ability, energy and initiative are justly compensated."

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphical methods.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more graphical problems.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

MARINE ENGINEERING (ME-5)—**Fuels**—Composition of fuels. Coal. Briquettes. Oil. Boilers—Types. Materials and construction. Boiler mountings and fire-room fittings. Draft. Boiler design. Boiler furnaces for coal and oil burning. Mechanical burners. Marine Engines—Types of engines. Reciprocating engines. Principal parts of reciprocating engines. The turbine for ship propulsion. Internal combustion engines. Diesel oil engine. Auxiliaries. Valves and valve gears. Propulsion and powering. Operation, Management and Repair—Boiler room routine. Routine for turbine propelled vessels. Boiler overhauling and repairs. Engine overhauling, adjustment, and repairs. Spare parts. Laying up marine machinery. Miscellaneous Machinery—Torsion meters. Steam steering engine. Electric steering gear. Transmission. Windlasses. Towing engines. Deck winches. Fire extinguishing apparatus. Air compressors. Refrigerating machinery. Evaporators.

APPLIED ELECTRICITY FOR PRACTICAL MEN (EE-7)—Fundamental principles. Current. Resistance. Electro-motive force. Magnetism. Direct current generators, parts and windings. Heating and power. D. C. motors and controllers. Alternating currents. Transformers. Polyphase principles. Alternators. A. C. motors. Controllers. Synchronous converter. A. C. and D. C. motor troubles. Storage batteries. Illumination principles. Wire and wiring.

Steam Engines and Turbines

(ME-4x)

This course is similar to the course in Engine Room Methods except that it goes more thoroughly into the technical features connected with the design, installation and operation of engines, turbines, generators, condensers and condenser auxiliaries.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphical methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

MECHANICS OF MATERIALS (CE-12)—Strength of materials. Deformation. Elastic change of length. Properties of materials of engineering. Beams. Theory of beams. Reactions. Vertical shear. Bending moment. Internal and external forces. Safe loads. Column formula. Combined stresses. Axial shear. Horizontal shear. Resilienco and work. Impact. Fatigue of materials. Torsion of shafts.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

STEAM ENGINES AND TURBINES (ME-3)—Fundamental principles. Work and power. Steam engines. Indicator diagrams. Mean effective pressure. Indicated horse power. Brake horse power.

Energy—Heat. Unit of heat. Mechanical equivalent of heat. Calorimeters. Generation of heat. Effect of heat on gases. Laws of gases. Properties of steam. Condensation and evaporation.

Heat, Work and Pressure—Properties of steam. Use of the steam tables. Indicator diagrams. The planimeter. The entropy diagram. Thermal efficiency.

The Steam Engine—Elementary principles. Classification of engines. Detailed consideration of the various parts of steam engine—slide valve, valve setting, eccentrics, reversing mechanisms, valve gears, governors, compound engines, condensing apparatus. Cooling ponds and towers.

Turbines—Temperature entropy diagrams as applied to superheated steam. Flow of steam. Characteristic types of turbines. Details of turbine construction. Nozzles and blades and the action of steam in them. Graphical solutions of problems in turbine design. Mechanical losses in turbines. Thermal losses in turbines. Commercial types of turbines. Problems in governing steam turbines. Various commercial types of governors. Transmission. Testing. Design. Problems involving strength of materials.

Steam Boilers, Superheaters and Economizers

(ME-3x)

This course covers the same work as the course in Boiler Room Methods with the exception that greater emphasis is given to the technical features connected with the design, installation and operation of boilers, superheaters, economizers, and boiler room auxiliaries. It is especially valuable to the man who desires a technical knowledge of the production of steam.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphical methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

MECHANICS OF MATERIALS (CE-12)—Strength of materials. Deformation. Elastic change of length. Properties of materials of engineering. Beams. Theory of beams. Reactions. Vertical shear. Bending moment. Internal and external forces. Safe loads. Column formula. Combined stresses. Axial shear. Horizontal shear. Resilience and work. Impact. Fatigue of materials. Torsion of shafts.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

STEAM BOILERS, SUPERHEATERS AND ECONOMIZERS (ME-4)—**General Principles**—Heat. Energy. Work. Power. Mechanical equivalent of heat. Temperature. Absolute zero. Conduction. Convection. Radiation. Insulation. Thermometer. Pyrometers. Expansion due to heat. Specific heat of solids and gases. Laws of gases.

Fuel—Principles of combustion. Flue gas analysis. Solid, liquid, and gaseous fuels. Anthracite and bituminous coal. Powdered coal. Fuel oil. Gas as a fuel.

Steam Boilers—Types of boilers. Heating surface. Steam space. Circulation. Baffling. Grates. Water regulators. Water gauges. Fusible plugs. Furnaces. Stokers. Superheaters. Economy due to superheated steam.

Feed Water Heating—Open heaters. Closed heaters. Live steam purifiers and heaters. Economizers. Limitations of economizers. Economizer heating surface.

Boiler Room Operation—Coal storage. Apparatus for boiler control. Economic operation of boilers. Selection of number, size and type of boilers. Number of boilers on line for maximum efficiency.

Engine Room Methods

(ME-7x)

There is at all times need of men thoroughly trained for the efficient operation of engines and electrical generators. This course will teach the fireman, oiler, or assistant engineer how to handle the problems of an engine room with maximum efficiency.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphical methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

ENGINE ROOM METHODS (ME-2)—Heat, work and pressure. Properties of steam. Formation of steam. Superheated steam. The indicator. Ratio of expansion. Mean effective pressure. Principles of the steam engine. Automatic high-speed engines. Corliss, cross-compound, tandem-compound, locomobile, and uniflow engines. Action of steam in cylinder. Steam engine testing. Slide valves. Poppet valves. Valve setting. Operation and maintenance. Condensers. Cooling ponds and towers.

Gears—Meyer valve gear. Stephenson link motion. Walschaert valve gear. Corliss valve gear.

Governors—Pendulum governors. Shaft governors. Inertia governors. Centrifugal governors.

Lubrication—Friction. Characteristics of oil. Testing oils. Lubricating systems.

Turbines—General principles. Types of turbines. Operation and maintenance.

APPLIED ELECTRICITY FOR PRACTICAL MEN (EE-7)—Fundamental principles. Current. Resistance. Electro-motive force. Magnetism. Direct current generators, parts and windings. Heating and power. D. C. motors and controllers. Alternating currents. Transformers. Polyphase principles. Alternators. A. C. motors. Controllers. Synchronous converter. A. C. and D. C. motor troubles. Storage batteries. Illumination principles. Wire and wiring.

Boiler Room Methods

(ME-1x)

The fireman or the engineer, who by the use of his knowledge of modern boiler room methods saves his firm money and trouble, is sure to be well paid.

This course will be of great help to you if it is your ambition to take entire charge of a boiler room and operate it economically. The principles governing the generation of steam and their application to economical operation of boiler plants are presented in a way that makes them easy to understand.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphical methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

FUELS AND FUEL ECONOMY (ME-1)—**Heat energy**—How it is expressed. Heat transfer in boilers. Radiation. Conduction. Convection. Boiler circulation. Steam formation. Characteristics of steam.

Fuels—Wood. Peat. Lignite. Anthracite coal. Bituminous coal. Pulverized coal. Fuel oil. Gas. Heat values. Proximate analysis. Ultimate analysis. Purchase of fuels.

Drafts—Draft losses. Value of chimneys. Forced draft. Use of fan. Induced draft.

Firing Methods—Burning hard coal. Burning soft coal. Dampers. Firing efficiency. Overfeed stokers. Underfeed stokers. Chain-grate stokers. Hand stokers.

Furnaces—Furnace for metallurgical and other manufacturing purposes. Furnace efficiency. Control apparatus for furnace operation.

BOILER ROOM METHODS (ME-17)—**Construction**—Strength of boilers. Boiler settings and connections. Steam, water, and blow-off piping. Safety valves. Gauges. Water columns. Safety plugs. Superheaters. Pumps and injectors. Economizers and feed water heaters.

Feed Water—Scale. Corrosion. Foaming. Priming. Treatment of feed water.

Operation—Inspection and care of boilers, attachments and auxiliaries. Boiler testing. Instruments. Regulators for economical operation. Number of boilers steaming from standpoint of economy.

Fuels and Fuel Economy

(ME-6x)

Fuel costs are high. Every pile of ash represents a small fortune gone up in smoke. Factory owners are searching for men scientifically trained in the modern methods that make for most efficient and economical operation of their power plants. The fireman and engineer, and the executive who buys the fuel, will learn from this course the modern theory and practice governing all kinds of fuels and their efficient use under varying conditions.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

FUELS AND FUEL ECONOMY (ME-1)—**Heat energy**—How it is expressed. Heat transfer in boilers. Radiation. Conduction. Convection. Boiler circulation. Steam formation. Characteristics of steam.

Fuels—Wood. Peat. Lignite. Anthracite coal. Bituminous coal. Pulverized coal. Fuel oil. Gas. Heat values. Proximate analysis. Ultimate analysis. Purchase of fuels.

Drafts—Draft loss. Value of chimneys. Forced draft. Use of fan. Induced draft.

Firing Methods—Burning hard coal. Burning soft coal. Firing efficiency. Overfeed stokers. Underfeed stokers. Chain-grate stokers. Hand stokers.

Furnaces—Furnaces for metallurgical and other manufacturing purposes. Furnace efficiency. Control apparatus for furnace operation.

Gas and Oil Engine Operation

(ME-12x)

This course meets the needs of operating enginers who wish to increase their knowledge of the principles and methods involved in the operation of stationary gas and oil engines. It will enable them to qualify as chief engineers of power plants equipped with these engines.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

GAS AND OIL ENGINE OPERATION (ME-6)—**Fuels**—Solid, liquid and gaseous fuels. Petroleum refining. Kerosene. Gasoline. Alcohol. Natural gas. Illuminating gas. Coke-oven gas. Blast-furnace gas.

Principles—Indicated horse power. Progressive combustion. Brake horse power. Explosion. Compression. Cooling. Heat balance.

Internal Combustion Engines—Four-stroke cycle. Two-stroke cycle. Heavy oil engines. Gasoline engines. Gas engines. Diesel engines.

Engine Details—Frames. Cylinders. Water jackets. Pistons. Packing rings. Valves. Cranks. Crank-shafts. Cam shafts. Bearings. Ignition systems. Mufflers. Lubricating systems.

Operation, Maintenance and Repair—Valve setting. Timing. Taking indicator cards. Adjusting bearings. Renewing packing. Starting and stopping. Taking down, repairing, and erecting engines.

APPLIED ELECTRICITY FOR PRACTICAL MEN (EE-7)—Fundamental principles. Current. Resistance. Electro-motive force. Magnetism. Direct current generators, parts and windings. Heating and power. D. C. motors and controllers. Alternators. A. C. motors. Controllers. Synchronous converter. A. C. and D. C. motor troubles. Storage batteries. Illumination principles. Wire and wiring.

Says He is Getting Full Value for His Money

I am well satisfied with my course and feel that I am getting full value for my money. I have had experience with other schools, so think I am able to judge.

—HOWARD L. SCARRETT, Skaneateles, N. Y.

Appreciates Instruction in Use of Slide Rule

I am very glad the use of the slide rule was included in this course of instruction. The explanations and sample problems were very rapidly understood. I can willingly recommend that part or any part of the course as far as I have gone, for the knowledge that I have gathered from it cannot be counted in dollars and cents.—GEORGE T. FOWLER, Scottdale, Pa.

In the Long Run Trained Heads Win

Power Stations

(EE-14x)

This course covers the generation of electric power and its delivery to the consumer. It includes steam-electric power stations, substations, switchboards and switching apparatus, transmission, and distribution. Offering a broad and thorough knowledge of this branch of engineering, it meets the needs of the operator, lineman, or other electrical worker who wishes to become the electrical engineer of a steam-electric power system.

The first work in the course, Power Stations, is the same as the first work in the course, Electrical Engineering. After taking up the fundamentals of electricity and the fundamentals of electrical engineering work in general the course, Power Stations, specializes in the many subjects necessary for a full understanding of electric power work.

Such projects as the building of new power stations to meet the increasing demands of our industries, and the electrification of our railroads, have grown so important as to become matters of national concern. Considerable development in this branch of the electrical field is sure to come.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary to deal with formulas and equations that occur later in the course. Graphs and how to make them.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphical methods.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

ELECTRICITY AND MAGNETISM (EE-5)—Electromotive force, current, and resistance. Electrical circuits. Nature and properties of magnetism. Magnetic circuits. Electro-magnetic induction. Principles of direct currents. First studies in alternating currents. Batteries, electrolysis, and the electrochemical industries.

ELECTRICAL DRAWING (EE-18)—Lesson-notes and blueprints supply the instruction and data needed for each drawing.

Motor Drawings—Complete assembly and detail drawings of a standard electric motor. Projections. Dimensions. Standard conventions.

Wiring Plans and Diagrams—Conventional symbols. Typical diagrams used by representative electrical manufacturers, both direct current starters and controllers and alternating current starters and controllers. Automotive diagrams. Standard symbols for wiring plans. Typical plans.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

ALTERNATING CURRENTS AND ALTERNATING CURRENT MACHINERY (EE-6) Principles of alternating currents; frequency, cycle, inductance, capacitance, reactance and impedance. Current and voltage relations in series and in parallel circuits, power factor. Single and polyphase circuits. Delta and Y-connected circuits. Power measurement. Principles and parts of alternators, synchronous motors, induction motors, rectifiers, transformers, and control apparatus. Installation, care and operation of alternating current machinery.

DIRECT CURRENT DYNAMO-ELECTRIC MACHINERY (EE-2)—Parts and construction of the direct current generator and motor. Magnetic circuits. Field excitation. Induced electromotive force. Characteristics of shunt, of series, and of compound machines. Elements of commutation and factors affecting it. Various means for securing proper commutation. Brushes and brush rigging. Voltage regulation of the generator. Parallel operation. Starting and stopping. Care of the generator. Principles of motor operation. Counter electromotive force. Service requirements and motor applications. Care. Troubles and remedies. Installation of motors and generators.

WIRING PRACTICE (EE-15)—Wire and wiring material. Wiring systems. Selection of the wiring system for a job. Costs. Methods of installing each system. Alternating and direct-current circuits. Code requirements regarding the loading of circuits. Contracts and specifications.

LIGHTING PRACTICE (EE-19)—Fundamental concepts of light. Illumination principles. Lighting units and lighting systems. Practical methods of laying out interior illumination systems. Depreciation in service of lighting units and reflecting surfaces. Modern maintenance records.

STEAM ENGINES, TURBINES AND BOILERS (ME-26)—**Fuels and Fuel Economy**—Fuels. Air required for combustion. Flue gas analysis. Draft. Firing methods. Stokers. Oil as fuel. Pulverized coal. Purchase of fuels.

Boilers and Superheaters—Fire tube boilers. Water-tube boilers. Boiler settings. Boiler attachments. Superheaters. Economizers. Pumps. Heaters. Economics of boiler room operation.

Steam Engines and Turbines—Principles of the steam engine. Automatic engines. Corliss engines. Uniflow engines. Governors. Compound engines. Principles of the steam turbine. Impulse turbines. Reaction turbines. Low pressure and bleeder turbines. Condensers. Circulation pumps. Air pumps. Tail pumps. Operation and maintenance of engine room machinery.

GENERATING STATIONS AND SUBSTATIONS (EE-23)—Layout of generating stations; the boiler room, generator room, battery room. Necessary equipment. Functions of the apparatus. Fuel storage and fuel handling. Ash disposal. Cranes and conveyors. Prime movers and their location. Generators and their location. Exciter equipment. Transformer equipment. Control and protective equipment. Substation layout. Automatic substations. Necessary equipment. Location of stations and substations. Duties of operators.

ELECTRICAL METERS (EE-11)—Construction and principles of operation of indicating, integrating, and recording meters. Current, pressure, power, power-factor and frequency meters. Synchroscope. Watt-hour meters. Ranges of meters. Shunts and multipliers. Instrument transformers. Installation and maintenance. Tests and testing equipment. Typical installations.

SWITCHBOARDS AND SWITCHING APPARATUS (EE-20)—General layout of switchboards. Necessary parts. Construction. Main and control circuit wiring. Voltages. Various types of switching apparatus and the location of each. The functions of switching apparatus. Importance of various switchboards. Safety precautions.

STORAGE BATTERIES (EE-8)—Construction of batteries. Electro-chemical principles of the lead-acid battery and of the alkaline battery. Uses of the battery. Operation and maintenance, care, inspection, and simple tests. Troubles and repair. Battery rooms.

POWER TRANSMISSION (EE-21)—Determination of the transmission voltage. Selection of the conducting material. Size and spacing of conductors. Voltage regulation. Types of towers. Poles. Insulators and insulation problems. Protective devices. Construction of lines. Operation of lines.

POWER DISTRIBUTION (EE-22)—Distributing power for industrial purposes and for lighting. Direct and alternating current systems. Permissible voltage drops. Underwriters' requirements. Overhead distribution and underground distribution. Service entrances.

ECONOMICS OF PUBLIC UTILITIES (EE-24)—Organization and management. Departmental relations. Duties of the staff. The function of the engineer. Relations of the engineer and labor. Financing. Costs, rates, efficiency, and earnings. Public service commissions. Relation of public utilities and the public. Service. Troubles and complaints. Advertising and sales. New business.

*__ADVANCED ALGEBRA__ (Ma-25)—A thorough study of the algebraic principles most useful and helpful to the practical man.

A knowledge of Advanced Algebra is required, as a preliminary subject to Analytic Geometry.

*__ANALYTIC GEOMETRY__ (Ma-24)—Selected lessons treating of the relation between the equation and the graph. This subject is particularly helpful in the field of engineering.

NOTE—The student may choose one of the following optional subjects. Both may be had at slight additional cost. Price on application.

*__HYDRAULIC PRIME MOVERS__ (CE-25)—Hydrostatics. Hydraulics. Flow of water through orifices, through tubes, pipes and conduits. Water supply and water power. Dynamic pressure of water. Impulse water wheels. Reaction water wheels and turbines. Selection of a water wheel or turbine. Speed regulation. Governors. Operation points.

*__INTERNAL COMBUSTION ENGINES__ (ME-27)—Principles of the internal combustion engine. Gaseous fuels. Liquid fuels. Four stroke cycle. Two stroke cycle. Governing. Ignition. Cylinder cooling. Oil engines. Diesel engines. Operation and maintenance of gas and oil engines.

*Optional. (See Page 12.)

Appreciates His Instructor's Corrections and Careful Explanations

I am sure you have the patience of Job or you could not so carefully explain each detail of my lessons.—C. E. REDINGER, 325 West Trail St., Jackson, Mich.

"I" Courses Meet Every Expectation

I wish to thank you and the members of your staff for the effort and interest which you took in explaining the work so that it became more easy for me to understand and more clearly fixed in my mind. I feel sure that anyone who is thinking of taking a home study course will find that a course with the United Y.M.C.A. Schools will meet their every expectation.
—HENRY V. JONES, 79 Rosedale St., Rochester, N. Y.

Finds Course Helpful in His Daily Work

I find my course in Machine Shop Tools and Methods useful and practical in my daily work. An old friend of mine, who has been a draughtsman for many years, looked over my textbooks and said: "With these books, and following the lessons as instructed, a man can become an expert draughtsman." So with the other useful work in my course I'm sure that it will be well worth while, and pay a big return later on.
—WESLEY PUCHETT, Moscow, Idaho.



THERE are now more than twenty million automobiles of one kind or another in use in the United States—every year the number is increasing. Men in every community are making good profits on repair work. Why shouldn't you? With a very small outlay of capital, and the necessary training, you can go into business for yourself and be independent. The automotive world doesn't need general handy men, but it is calling for intelligent, trained men with a precise technical knowledge of the automobile. Get this knowledge and training from our automobile courses. They are planned and written to meet the needs of the man who studies at home.

Instruction by Experienced Men

This instruction is directed by Geo. B. Preston, M.M.E., of the Mechanical Department and H. H. Ketcham, E.E., of the Electrical Department. These men are assisted by C. C. Sleffel of the Mechanical Department, and W. E. Lindsay, M.E. (E.E.), graduate of Cornell University, and member A.S.M.E., formerly instructor at Pratt Institute. His professional services include several years in machine shop practice and machine design, and other engineering work in the mechanical and electrical fields. Another able assistant is H. T. Hoot, B.Sc., graduate of Rutgers College, six years' experience in mechanical and electrical, industrial and research work, Jr. member of A.S.M.E.

Applied Automobile Engineering

(ME-23x)

This course takes up in detail the mechanical and electrical features of the motor vehicle and the principles governing its construction. Repair shop equipment and methods receive special attention.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5) — Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

SHOP MATHEMATICS, ADVANCED (Ma-21)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop.

AUTOMOBILE AND MOTOR TRUCK OPERATION (ME-22)—Various types of automobiles with characteristics of each. Clear and practical descriptions of automobile parts. Troubles and remedies. Care and operation of the automobile.

ELECTRICAL EQUIPMENT OF THE AUTOMOBILE (EE-9)—Magnetos. Batteries. Motors. Generators. Starting and lighting systems. Wiring diagrams. Charging equipment. Electrical accessories. Testing.

STORAGE BATTERIES (EE-8)—Types of storage batteries and their characteristics. Charging and charging equipment. Troubles and remedies. Repair. Testing.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

AUTOMOBILE CONSTRUCTION AND REPAIR (ME-20)—Locating trouble. Carburetors. Lubrication systems. Ignition coils. Chassis and running gears. Brakes. Clutches. Transmissions. Steering systems. Axles. Differentials. Wheels. Rims. Tires. Manifolds. Springs. Fuel supply systems. Adjustments. Minor repairs. Major repairs. Use of machine tools. Heat treatment of metals. Repair of springs. Materials used in automobiles. Shop equipment for repairing automobiles and trucks.

Automobile Construction and Repair

(ME-21x)

With millions of cars in use in this country, the demand for trained mechanics is constantly increasing. This course is for the apprentice or mechanic who desires to specialize in the mechanics of automobile construction and repair.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

SHOP MATHEMATICS, ADVANCED (Ma-21)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop.

AUTOMOBILE AND MOTOR TRUCK OPERATION (ME-21)—Various types of automobiles with characteristics of each. Clear and practical descriptions of automobile parts. Types of magnetos and generators. Storage batteries. Starting, lighting and ignition systems. Care and operation of the automobile.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

AUTOMOBILE CONSTRUCTION AND REPAIR (ME-20)—Locating trouble. Carburetors. Lubrication systems. Ignition coils. Condensers. Timers. Battery systems. Magnetos. Storage batteries. Starting systems. Lighting systems. Chassis and running gears. Brakes. Clutches. Transmissions. Steering systems. Axles. Differentials. Wheels. Rims. Tires. Manifolds. Springs. Fuel supply systems. Adjustments. Minor repairs. Major repairs. Use of machine tools. Heat treatment of metals. Repair of springs. Materials used in automobiles. Shop equipment for repairing automobiles and trucks.

Automobile and Motor Truck Operation

(ME-22x)

This course will meet the requirements of owners or drivers of automobiles or motor trucks. It will make them more proficient in the care and operation of the machine and enable them to make minor repairs.

Subjects Covered in This Course:

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

AUTOMOBILE AND MOTOR TRUCK OPERATION (ME-21)—Various types of automobiles with characteristics of each. The gasoline engine, care and operation. Clear and practical descriptions of types of carburetors. Systems of lubrication. Wiring for the automobile engine. Types of magnetos and generators. Storage batteries. Starting and lighting systems. Clutches and transmissions. Rear axles and differentials. Wheels, rims, tires. Troubles and remedies. Care and operation of the automobile.

Electrical Equipment of the Automobile

(EE-4x)

This course is for the automobile electrician and the general automobile mechanic who requires a thorough knowledge of ignition systems, both battery and magneto, of starting and lighting systems, and of ignition and vehicle storage batteries, as well as some acquaintance with electrical accessories.

Subjects Covered in This Course:

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

SHOP ALGEBRA (Ma-23)—Formulas and how to use them. How to use tables and charts.

ELECTRICAL EQUIPMENT OF THE AUTOMOBILE (EE-9)—Electricity and magnetism. Principles and essential parts of all ignition systems. Principles, characteristics, construction, operation and care of generators and starting motors. Principles and essential parts of starting and lighting systems. Requirements of the ideal headlight. State laws. Electrical accessories. Wiring diagrams showing complete electrical systems on all standard makes of cars. How to read and how to use these diagrams.

STORAGE BATTERIES (EE-8)—Construction and manufacture of various types of batteries. Chemical actions in the battery on charge and on discharge. Voltage and voltage changes. Use of the hydrometer. Charging. Care of the battery. Battery troubles and their remedies. Repair shop equipment and methods. Battery service.

The three hours following 7 o'clock in the evening may be used to put yourself ahead—to grow to be a bigger man, fitted for leadership, larger responsibility, more congenial work, a better paying job. The "Y" will help you to make the most of your 7 o'clocks.

ELECTRICAL



H. H. KETCHAM

THE field of Electricity, although new, is well established and constantly growing; and it offers unusual opportunities to earnest, ambitious men. Today villages and even isolated homes are installing electric improvements. Radio telegraphy has become commonplace. Some go so far as to predict that soon coal for power or for lighting purposes will no longer be moved away from the coal regions—that it will there be turned into electricity; and that power, light and heat will be transmitted over wires, for use throughout the entire country.

If a man gives conscientious work to the study of one of these electrical courses, he will get all the knowledge he would acquire in the technical school with the exception of laboratory and shop experience, which can be obtained by actual practice. In addition, he will draw a good salary while learning the practical work, thus keeping a step ahead.

Every employer is inclined to give preference to the applicant who has been studying for his job rather than to the young man who has done no reading or studying along the line of his chosen occupation.

The electrical field affords opportunities almost without limit. Large salaries are common with the big interests. Not every man may reasonably hope to climb to a salary of from $5,000 to $15,000 a year, but every ambitious man can expect to earn enough in electrical work to support himself and family in comfort if he makes the most of his opportunities.

Instruction by Experienced Men

The instructors of the Electrical Engineering department are well fitted for their respective positions. H. H. Ketcham, E.E., the head of this department, is a man of broad education and experience. After graduating from Lehigh University he spent ten years in the practical engineering field, including four years of control work. He is an Associate member of the American Institute of Electrical Engineers and a member of the American Association for the Advancement of Science. Assisting Mr. Ketcham in the instruction work is N. S. Dickinson, a graduate of Union College, who has had ten years' experience in the teaching and practice of engineering. He has occupied such positions as head of the Electrical department of the Newark Technical School, Instructor in Radio Officers School at Columbia University and consulting and designing engineer in industrial work. Another able assistant is John B. Dixon, who, after graduating from Pratt Institute, spent several years in the engineering department of the Westinghouse Electric Manufacturing Company and with the Public Service Electric Company of New Jersey.



JOHN B. DIXON

The instructors and consulting staff are all experienced teachers and among them are acknowledged masters of special electrical subjects. Some have studied abroad and all are members of one or more national engineering societies.

Electrical Engineering

(EE-12x)

This course offers a foundation for all branches of electrical engineering for it covers every fundamental electrical subject. It will not only meet the needs of the practicing engineer, but of the student of electrical engineering as well. It is confined to the groundwork of the profession, and treats the essential subjects adequately.

As the course is based on the study of principles and their applications to daily work, it is of especial value to the practical man for it supplies him with the "reasons why."

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary to deal with formulas and equations that occur later in the course. Graphs and how to make them.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

TRIGONOMETRY (Ma-4) — Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

ELECTRICAL DRAWING (EE-18)—Copious lesson notes and blueprints. Assembly and detail drawings of standard electric motor. Standard conventions. Wiring plans and diagrams. Conventional symbols. Typical diagrams used by representative electrical manufacturers.

ELECTRICITY AND MAGNETISM (EE-5)—**Electricity**—Sources of electricity. Electromotive force. Current. Resistance. Ohm's law. Conductance. Electrical units. Electrical circuits.

Magnetism—Permanent magnets. Electromagnets and electromagnetism. Magnetic circuits. Magnetomotive force. Magnetic flux. Reluctance. Permeability. Hysteresis. Electromagnetic induction.

Direct Currents—Construction and operation of DC generators, motors, and control apparatus. Motor applications.

Principles of Alternating Currents—The alternator. AC motors. Control apparatus. Transformers. (A preliminary study.)

Electrochemistry—Primary and storage batteries. Industrial applications of electrolysis.

Electrical Distribution. Electric Illumination.

ADVANCED ALGEBRA (Ma-25)—A thorough study of the algebraic principles most useful and helpful to the practical man.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

ANALYTIC GEOMETRY (Ma-24)—Selected lessons treating of the relation between the equation and the graph. This subject is particularly helpful in the field of engineering.

ALTERNATING CURRENTS (EE-6)—**Principles of Alternating Currents**—Frequency and cycle. Inductance. Inductive reactance. Capacitance. Condensive reactance. Impedance. Power and power factor. Apparent power. Effective power. Reactive power. Vector diagrams. The electrical degree. Electromagnets. Electromagnetic induction. Leading and lagging currents.

AC Circuits—Current and voltage relations in series and in parallel circuits. Relation of resistance and reactance to impedance. Single phase circuits. Polyphase circuits. Delta and Y connections. Current and voltage relations in the line and in the load. Power relations. Power measurement. Wiring calculations. Transmission and distribution. Stations. Sub-stations.

AC Machinery—Principles and parts of alternators, synchronous motors, induction motors, series motors, synchronous converters, rectifiers, transformers, and control apparatus. Installation, care and operation of AC machinery.

DIRECT CURRENT DYNAMO-ELECTRIC MACHINERY (EE-2)—**The DC Dynamo**—The armature and its construction. Ventilation. Lap and wave windings. Laying out windings. Construction of the commutator. Stationary armatures. Construction of field poles and yokes. Field windings. Ventilation of frame. Construction of bases. The magnetic circuit. Field excitation. Leakage. Saturation of parts. Laminated parts.

Principles of Generator Operation—Characteristics of shunt, series, and compound machines. Building-up. Voltage regulation. Compounding. Efficiency and losses. Parallel operation. Starting and stopping. Care of generators.

Commutation—Inductance of armature coils. Armature reaction. Various means for securing proper commutation. Compensating windings, shape of pole tips. Brushes and brush rigging.

Motor Operation—Motor starters and controllers. Service requirements. Motor applications. Care of motors. Troubles and their remedies. Characteristics of commutation peculiar to the motor.

Miscellaneous—Switchboards and accessories. Protective devices. Installation of motors and generators.

ELECTRIC ILLUMINATION (EE-10)—Fundamental concepts of light. Illumination measurement. Reflectors and enclosing glassware. Principles of illumination design. Lighting systems. Location of lighting units. Proper illumination values. Typical installations. Maintenance of illumination systems. Depreciation in service of light-

ing units and reflecting surfaces. Modern maintenance methods. Cleaning schedules. The footcandle meter.

WIRING PRACTICE (EE-15)—Wire and wiring material. Wiring systems. Selection of the wiring system for a job. Costs. Methods of installing each system. Alternating and direct-current circuits. Code requirements regarding the loading of circuits. Contracts and specifications.

DIRECT CURRENTS (EE-13) — Principles underlying uses of direct current electrical energy. Apparatus involved. Theory emphasized. Practical matters included. Insulation and insulating materials. High voltage DC phenomena. Telegraphy. Telephony.

ALTERNATING CURRENT MACHINERY (EE-14)—Principles underlying construction and operation of AC machinery. Problems found in practice.

Dynamo-Electric Machinery—Synchronous generators, motors, condensers and converters. Induction motors. Single-phase commutator motors. Motor generator sets.

Static Machinery—The transformer. Rectifying devices.

CONTROLLERS FOR ELECTRIC MOTORS (EE-12)—Operation and maintenance of industrial controllers. Essential requirements of motor control. Types of controllers. Functions of the controller. Essential parts. Design.

NOTE.—One of the following elective subjects is required. Both may be had at slight additional cost. Price on application.

†**STEAM ENGINES AND TURBINES** (ME-3)—Properties of steam. Use of the steam tables. Indicator diagrams. The planimeter. The entropy diagram. Thermal efficiency. Mean effective pressure. Indicated horse power. Brake horse power. Elementary principles. Classification of engines. Detailed consideration of the various parts of steam engine. Compound engines. Condensing apparatus. Cooling ponds and towers. Temperature entropy diagrams as applied to superheated steam. Characteristic types of turbines. Details of turbine construction. Graphical solutions of problems in turbine design.

†**FUELS AND FUEL ECONOMY** (ME-1)—Complete discussion of characteristics of various fuels, as wood, peat, coal, oil and gas. Fuel analysis. Chemistry of combustion. Fuel gas analysis. Coal fuel. Hand-firing methods. Mechanical stokers. Pulverized coal as a fuel. Gas and oil as fuels. Furnaces for metallurgical purposes.

NOTE.—The student may choose any two of the following optional subjects. If more than two subjects are desired they may be had at a slight additional cost. Price on application.

*†**CALCULUS** (MA-8)—A simple and direct treatment of both branches of the calculus applied to problems in dynamics; physics; and mechanical, electrical, and civil engineering. Many interesting problems discussed.

*†**MECHANICS OF MATERIALS** (CE-12)—Strength of materials. Deformation. Elastic change of length. Properties of materials of engineering. Beams. Theory of beams. Reaction. Vertical shear. Bending moment. Internal and external forces. Safe loads. Column formulas. Combined stresses. Axial shear. Horizontal shear. Resilience and work. Impact. Fatigue of materials. Torsion of shafts.

*†**USE OF THE SLIDE RULE** (CE-1)—Mechanical multiplication and division. Roots, powers. Representations of logarithms on the scales of the rule. Setting the rule to perform various arithmetical calculations. Locating the decimal point. How to perform a series of operations on the rule.

*†**FACTORY MANAGEMENT AND INDUSTRIAL EFFICIENCY** (ME-10)—Course for mechanics, foremen, superintendents, and managers who desire to make themselves more valuable. It will increase their knowledge of the most efficient modern production methods, including handling of materials. It discusses exhaustively the best methods of handling men. It considers the various departmental relationships, purchasing of materials, various wage systems and accounting.

*†**FOREMANSHIP** (ME-11) — The foreman's place in industry. Methods of getting production. Departmental relationships. Developing interest. Materials and their handling. Working machinery to capacity. Team work. Safeguarding the worker. Principles of organization. Systems of wage payment. Art of management.

*†**COST ACCOUNTING** (Co-4) — Principles. Methods. Indirect expense accounts. Stores accounting and records. Costs. Time and pay records. Indirect expense. Fixed charges. Expense distribution. Representative cost systems. Graphic presentation of cost data. Use of charts. Forms.

*†**STORAGE BATTERIES** (EE-8)—**Construction of Batteries**—Manufacture of battery parts. Types of plates. Types of batteries. Assembly operations.

Electrochemical Principles—Chemical actions in the battery on charge and on discharge. Voltage changes on charge and discharge. Changes in the density of the electrolyte.

Operation and Maintenance—Methods of charging. Charging equipment. Care of the battery, inspection, and simple tests, under operating conditions. Battery rooms in standby and other service. Care of idle batteries.

Repair—Battery troubles and their remedies; the extensive treatment of this subject is arranged under the various battery parts.

Battery Service—Types of batteries, installation, and operating conditions in ignition and starting, vehicle, standby, farm and country home lighting, train lighting, radio, and marine service.

**Optional.* (*See Page* 12.)
†*Elective.*

There are three milestones along the road to Success—Imagination, Preparation, Determination. Those at the top have done their share of imagining and a great deal of preparing, but they have also passed the other milestone—Determination. They cultivated a backbone where other folks have only a wishbone.

Shorter Electrical Engineering

(EE-13x)

"Shorter Electrical Engineering" is intended for men who desire a comprehensive knowledge of electricity and who have time only for the work of a specialized engineering course. It covers thoroughly the principles of electricity and magnetism, of direct and alternating currents, and of common electrical apparatus, including the practical application of these principles to industrial and commercial needs. This is followed by a detailed study of a specific electrical subject, or if preferred, of an allied engineering subject.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical consideration emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary to deal with formulas and equations that occur later in the course. Graphs and how to make them.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

TRIGONOMETRY (Ma-4) — Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more graphical problems.

ELECTRICITY AND MAGNETISM (EE-5)—**Electricity**—Sources of electricity. Electromotive force. Current. Resistance. Ohm's law. Conductance. Electrical units. Electrical circuits.

Magnetism—Permanent magnets. Electromagnets and electro-magnetism. Magnetic circuits. Magnetomotive force. Magnetic flux. Reluctance. Permeability. Hysteresis. Electromagnetic induction.

Direct Currents—Construction and operation of DC generators, motors, and control apparatus. Motor applications.

Principles of Alternating Currents—The alternator. AC motors. Control apparatus. Transformers. (A preliminary study.)

Electrochemistry—Primary and storage batteries. Industrial applications of electrolysis.

Electrical Distribution—Electrical Illumination.

ALTERNATING CURRENTS AND ALTERNATING CURRENT MACHINERY (EE-6) **—Principles of Alternating Currents**—Frequency and cycle. Inductance. Inductive reactance. Capacitance. Condensive reactance. Impedance. Power and power factor. Apparent power. Effective power. Reactive power. Vector diagrams. The electrical degree. Electromagnets. Electromagnetic induction. Leading and lagging currents.

AC Circuits—Current and voltage relations in series and in parallel circuits. Relation of resistance and reactance to impedance. Single phase circuits. Polyphase circuits. Delta and Y connections. Current and voltage relations in the line and in the load. Power relations. Power measurement. Wiring calculations. Transmission and distribution. Stations. Sub-stations.

AC Machinery—Principles and parts of alternators, synchronous motors, induction motors, series motors, synchronous converters, rectifiers, transformers, and control apparatus. Installation, care and operation of AC machinery.

DIRECT CURRENT DYNAMO-ELECTRIC MACHINERY (EE-2)—**The DC Dynamo**—The armature and its construction. Ventilation. Lap and wave windings. Laying out windings. Construction of commutator. Stationary armatures. Construction of field poles and yokes. Field windings. Ventilation of frame. Construction of bases. The magnetic circuit. Field excitation. Leakage. Saturation of parts. Laminated parts.

Principles of Generator Operation—Characteristics of shunt, series, and compound machines. Building-up. Voltage regulation. Compounding. Efficiency and losses. Parallel operation. Starting and stopping. Care of generators.

Commutation—Inductance of armature coils. Armature reaction. Various means for securing proper commutation. Compensating windings, shape of pole tips. Brushes and brush rigging.

Motor Operation—Motor starters and controllers. Service requirements. Motor applications. Care of motors. Troubles and their remedies. Characteristics of commutation peculiar to the motor.

Miscellaneous—Switchboards and accessories. Protective devices. Installation of motors and generators.

WIRING PRACTICE (EE-15)—Wire and wiring material. Wiring systems. Selection of the wiring system for a job. Costs. Methods of installing each system. Alternating and direct current circuits. Code requirements regarding the loading of circuits. Contracts and specifications.

NOTE: In addition to the subjects already listed one only of the following elective subjects is required to complete the Shorter Electrical Engineering Course. If others are desired they may be had at an additional cost. Price on application.

ELECTRIC ILLUMINATION (EE-10)—Fundamental concepts of light. Illumination measurement. Reflectors and enclosing glassware. Principles of illumination design. Lighting systems. Location of lighting units. Proper illumination values. Typical installations. Maintenance of illumination systems. Depreciation in service of lighting units and reflecting surfaces. Modern maintenance methods. Cleaning schedules. The foot-candle meter.

STORAGE BATTERIES (EE-8)—Construction of batteries. Manufacture of battery parts. Assembly operations. Chemical actions in the battery on charge and on discharge. Voltage changes on charge and discharge. Methods of charging. Battery rooms in standby and other service. Care of idle batteries. Battery troubles and their remedies. Battery service.

CONTROLLERS FOR ELECTRIC MOTORS (EE-12)—Operation and maintenance of industrial controllers. Essential requirements of motor control. Types of controllers. Functions of the controller. Essential parts. Design.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

FUELS AND FUEL ECONOMY (ME-1)—Complete discussion of characteristics of various fuels, as wood, peat, coal, oil and gas. Fuel analysis. Chemistry of combustion. Fuel gas analysis. Coal fuel. Hand-firing methods. Mechanical stokers. Pulverized coal as a fuel. Gas and oil as fuels. Furnaces for metallurgical purposes.

FACTORY MANAGEMENT AND INDUSTRIAL EFFICIENCY (ME-10)—Most efficient modern production methods, including handling of materials. It discusses exhaustively the best methods of handling men. It considers the various departmental relationships, purchasing of materials, various wage systems and accounting.

FOREMANSHIP (ME-11) — The foreman's place in industry. Methods of getting production. Departmental relationships. Developing interest. Materials and their handling. Working machinery to capacity. Team work. Safeguarding the worker. Principles of organization. Systems of wage payment. Art of management.

COST ACCOUNTING (Co-4) — Principles. Methods. Indirect expense accounts. Stores accounting and records. Costs. Time and pay records. Indirect expense. Fixed charges. Expense distribution. Representative cost systems. Graphic presentation of cost data. Use of charts. Forms.

SUBSTITUTE SUBJECTS—Instead of the required elective subject the student may substitute any one of the three following groups:

Group 1

READING OF DRAWINGS (Dr-44)—Instruction by means of blueprints of machine details. Complete representation of an object by three or more views, with or without sections. Meaning of heavy full lines, light full lines, dotted lines, dot and dash lines. Correct methods of dimensioning. Conventional methods of representing standard parts. Notes and specifications.

***READING OF ELECTRICAL DRAWING** (EE-16)—Typical drawings of a standard motor. Wiring diagrams of typical face plate and drum type manual starters, of contractor and autotransformer type automatic starters, of controllers, of panels, of automotive systems, and of a wireless unit. Symbols for wiring diagrams.

Group 2

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

***ELECTRICAL DRAWING** (EE-18)—Copious lesson notes and blueprints. Assembly and detail drawings of a standard electric motor. Standard conventions. Wiring plans and diagrams. Conventional symbols. Typical diagrams used by representative electrical manufacturers.

Group 3

ADVANCED ALGEBRA (Ma-25)—A thorough study of the algebraic principles most useful and helpful to the practical man.

†ANALYTIC GEOMETRY (Ma-24)—Selected lessons treating of the relation between the equation and the graph. This subject is particularly helpful in the field of engineering.

Electricity and Magnetism

(EE-8x)

With the aid of special experimental work this course presents the principles of Electricity and Magnetism, and then covers the more common applications of these principles. It is a brief treatment of electrical theory and fact, dealing with all the principal fundamental electrical laws and actions. The student is taught in a simple, clear manner what the essential apparatus is and how and why each piece of apparatus works. In its broader sense this course offers a survey of the entire field of electricity.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary to deal with formulas and equations that occur later in the course. Graphs and how to make them.

ELECTRICITY AND MAGNETISM (EE-5)—Nature of electricity. Sources of electricity. Electromotive force. Current. Resistance. Ohm's law. Conductance. Electrical units. Electrical circuits. Power. Heating.

Magnetism—Nature and properties of magnetism. Permanent magnets. Electromagnets and electromagnetism. Magnetic circuits. Magnetomotive force. Magnetic flux. Reluctance. Permeability. Hysteresis. Electromagnetic induction.

Direct Currents—Types of dynamos. Principles. Characteristics, construction and operation of DC generators. motors and control apparatus. Motor applications.

Alternating Currents (Preliminary study)—Principles of alternating currents. The alternator. AC motors. Control apparatus. Transformers.

**Optional after completing Mechanical Working Drawing (Dr-47)*
†Optional after completing Advanced Algebra (Ma-25)

Electrochemistry—Primary batteries and storage batteries. Useful and harmful electrolysis. Industrial applications of electrolysis. Some principles of general chemistry.

Miscellaneous — Electrical measurements and measuring instruments. Power stations and power transmission and distribution. Electric illumination.

Direct Current Dynamo-Electric Machinery

(EE-10x)

The course is intended particularly for the operator and the maintainer of D. C. motors and generators, but it includes also the needs of the installer, the repairman, the tester, and the executive who selects machines for specified service. The uses of electrical energy, referring solely to types of loads, together with types of machines and their operating characteristics, supply basis for the selection, operation, and care of the machines.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary to deal with formulas and equations that occur later in the course. Graphs and how to make them.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

DIRECT CURRENT DYNAMO-ELECTRIC MACHINERY (EE-2)—**The DC Dynamo**—The armature and its construction. Ventilation. Lap and wave windings. Laying out windings. Construction of the commutator. Stationary armatures. Construction of field poles and yokes. Field windings. Construction of bases. The magnetic circuit. Field excitation. Leakage. Saturation of parts. Laminated parts.

Principles of Generator Operation—Characteristics of shunt, series and compound machines. Building-up. Voltage regulation. Compounding. Efficiency and losses. Parallel operation. Starting and stopping. Care.

Commutation—Inductance of armature coils. Armature reaction. Various means for securing proper commutation. Compensating windings, shape of pole tips. Brushes and brush rigging.

Motor Operation—Motor starters and controllers. Service requirements. Motor applications. Care of motors. Troubles and their remedies. Characteristics of commutation peculiar to the motor.

Miscellaneous—Switchboards and accessories. Protective devices. Installation of motors and generators.

Alternating Currents

(EE-6x)

This course, which is comprehensive in every detail, will be of value to the practical electrician. The construction, installation, and particularly the operation and care of alternating current apparatus require a thorough grasp of the principles of alternating currents and alternating current machinery. These principles are the foundation of this course upon which are based the practical applications most essential to the electrical worker.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

TRIGONOMETRY (Ma-4) — Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

ELECTRICITY AND MAGNETISM (EE-5)—Nature of electricity. Electromotive force. Current. Resistance. Conductance. Electrical circuits. Power. Heating.

Magnetism—Nature and properties of magnetism. Permanent magnets. Electromagnets and electromagnetism. Magnetic circuits. Magnetomotive force. Magnetic flux. Reluctance. Permeability. Hysteresis.

The United Y.M.C.A. Schools exist for young men ambitious to realize their Bigger Selves, who are willing to use their spare hours to that end. During the last twelve months 140,000 *such men have enrolled in the resident classes of the United Y.M.C.A. Schools, or for the Correspondence Courses offered by the Extension Division.*

Direct Currents—Types of dynamos. Principles. Characteristics, operation and construction of DC generators, motors and control apparatus. Motor applications.

Alternating Currents (Preliminary Study)—Principles of alternating currents.

Miscellaneous—Electrical measurements and measuring instruments. Electrical distribution. Electrical illumination.

ALTERNATING CURRENTS (EE-6)—Principles of Alternating Currents.—Frequency and cycle. Inductance. Inductive reactance. Capacitance. Condensive reactance. Impedance. Power and power factor. Apparent power. Effective power. Reactive power. Vector diagrams. Electromagnetic induction. Leading and lagging currents.

AC Circuits—Current and voltage relations in series and in parallel circuits. Relation of resistance and reactance to impedance. Single phase circuits. Polyphase circuits. Delta and Y connections. Current and voltage relations in the line and in the load. Power relations. Power measurement.

Wiring Calculations—Single phase and polyphase circuits. Inductive and non-inductive loads.

Transmission and Distribution—Modern systems. Modern practice in voltages. Stations. Sub-stations.

AC Machinery—Principles and parts of alternators, synchronous, induction, and series motors, synchronous converters, rectifiers, transformers, and control apparatus.

Operation of AC Machinery—Installation, care, and operation of transformers, alternators and synchronous motors, induction motors, synchronous converters, mercury-arc rectifiers, vibrating rectifiers, Tungar rectifiers.

Applied Electricity for Practical Men

(EE-7x)

This course is for the installer and the operator of electrical appliances, and for the workman building them. It deals with the principles governing the use and care of electrical apparatus with which the electrician meets commonly in his practical every-day work. It is a short, general course giving the essential elements of electricity for practical electrical men.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction which will be necessary in order to deal with the formulas and equations that occur later in the course. Graphs and how to make them.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

TRIGONOMETRY (Ma-4) — Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

APPLIED ELECTRICITY FOR PRACTICAL MEN (EE-7)—Fundamental Electrical Principles—Electromotive force. Current. Resistance. Electrical units. Ohm's law. Sources of electrical energy. Electrical circuits. Conductors and insulators. Electrical diagrams.

Fundamental Magnetic Principles—Nature and properties of magnetism. Magnetic fields. Permanent magnets. Electromagnets.

Direct Currents and DC Machinery—Parts and construction of the dynamo. The armature. The commutator. Ventilation. Lap and wave windings; the advantages of each. Laying out windings. Field poles. Field windings. The magnetic circuit. Magnetic saturation and leakage. Operation of the generator. Principles involved. Induced electromotive force. Characteristics of shunt, series, and compound machines. Building-up. Manual and automatic voltage regulation. Parallel operation. Care of generators. Elements of commutation and factors affecting it. Brushes and brush rigging. Operation of the motor. Principles involved. Counter electromotive force. Motor starters and controllers. Service requirements. Care of motors. Troubles and their remedies. Installation of motors and generators. Mechanical and electrical connections. Switchboards and instruments. Switches, fuses, and circuit-breakers. Other protective devices. Electric power. Power losses and heating. Distribution of electrical energy. Insulation and grounds.

Alternating Currents and AC Machinery—Principles of alternating currents. Cycle and frequency. Inductance and capacitance. Resistance, reactance, and impedance. Effective values of electromotive force and current. Phase relations. Power factor. Vectors and vector diagrams. Leading and lagging currents. Single phase circuits. Polyphase circuits. Delta and Y connections. Power measurement. Principles and construction of the transformer. Windings. Insulation. Methods of cooling. Types. Operation. Connections. Care and troubles. Construction of the alternator and synchronous motor. The armature and its parts. Single and polyphase windings. Field windings. Operation of the alternator. Generation of alternating electromotive force. Counter electromotive force in the synchronous motor and the synchronous condenser. Alternators in parallel. Starting and stopping. Care of the alternator. Alternating current switchboards, instruments, and protective devices. AC switching. The induction motor and its construction. Rotating fields. Characteristics of the wound rotor and squirrel cage types. Operation. Starting methods. Torque. Performance. Troubles and remedies. Other AC machinery. Single-phase series commutator motor. The repulsion motor. The synchronous converter, its construction, operation, and uses. Voltage regulators. Care of AC apparatus. Installation of AC motors and generators. Mechanical and

electrical connections. Special service requirements. Prime movers.

Storage Batteries—Construction of the lead-acid cell. Electrochemical actions on charge and discharge. Types of cells, capacities, and current rates. Use of the hydrometer. Charging. Care of the battery; inspection and simple tests. Construction of the alkaline cell. Principles of action. Characteristics of its operation. Sizes and types of cells. Care and maintenance; simple tests. Typical uses of the storage battery. Care and operation of charging apparatus. Operation and maintenance suggestions.

Electric Illumination—Fundamental concepts of light. Illumination measurement. Reflectors and enclosing glassware. Principles of illumination design. Lighting systems. Location of lighting units. Proper illumination values. Typical installations. Maintenance of illumination systems. Depreciation in service of lighting units and reflecting surfaces. Modern maintenance methods. Cleaning schedules. The foot-candle meter.

Wire and Wiring—Wire sizes and gauge systems. Various insulations. Wiring systems and methods of installation. The National Electric Code. Wiring calculations for DC installations and single phase and polyphase AC installations, for lighting and for power.

Armature Winding

(EE-1x)

Prepared for the armature winder, the armature repairman, and the maintenance electrician, this course covers the initial winding of AC and DC generator and motor armatures in manufacture; the methods of finding trouble, and the way to correct it. The actual work of the mechanic and electrician is handled fully. This study is for the experienced practical man, and requires a preliminary working knowledge of dynamos and their troubles. It is intended to advance a man already in this work, but not by itself to prepare him for it. Students not qualified for this course should take other courses first; suggested courses upon application.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

ARMATURE WINDING (EE-1)—**Armatures**—Nomenclature and definitions. Types of coils and windings. Types of slots. Illustrations and diagrams. Symbols and formulas. Stripping armatures. Preparation of cores for rewinding. Coil winding. Application of the windings to the cores. Connecting, hooding, banding and balancing. Insulating materials; suitability; requirements for different voltages. Varnishes and their solvents. Drying and baking. Tests for locating faults. Insulation resistance measurements.

Direct Current Windings—Lap windings; single, multiplex, reentrant. Wave windings; multiplex or series-parallel. Symmetrical windings. Equalizers. Small and large armatures; usual practice in design and manufacture. Connecting up commutators. Armatures and commutators in the repair shop. Remedies for armature, commutator, and brush troubles. Armatures readapted to changed operating conditions in voltage and speed. Diagrams; winding and connecting tables.

Alternating Current Windings — Distributed and concentrated windings. Lap and wave windings. Single phase and polyphase windings for rotors and stators. Connecting up the windings. Rewinding in the repair shop: single phase motors; polyphase induction motors; large stators. Chord factor. Tables of various connections and resulting voltages. Reconnecting induction motors for change in phases, voltage, poles, speed or frequency; combined changes.

General—Receiving, handling, and installing new machines. Inspecting and overhauling motors and generators and auxiliary apparatus. Causes and remedies of troubles. Ways of overcoming operating difficulties. Machines and hand tools for the armature winding shop. Methods and equipment for the repair shop. Cost estimate of repairs. Tables of wire gauges, wiring, and other data necessary to the armature winder. How to collect and keep useful notes.

Controllers and Wiring Diagrams

(EE-9x)

An advanced course for the electrical worker who desires to specialize on controller work. In this study emphasis is placed on industrial controllers from the viewpoint of operation and maintenance. Controller work is an advanced subject, and the study of it requires as a preliminary qualification some knowledge of the principles of electricity and magnetism, and of the operation of direct and alternating current machinery. Students not qualified for this course should take other courses first; suggested courses upon application.

You Can't Drift to Success—
The Better Jobs are Up-stream.

Subjects Covered in This Course:

CONTROLLERS AND WIRING DIAGRAMS (EE-4)—Controllers—Functions of the controller. Types of controllers. Manual and automatic operation. Essential parts. Design. Rolling, butt, and sliding contacts. Contact pressure. Size of contacts. Magnetic blowouts and arc splitters.

Resistors—Wire and ribbon types. Grids. The carbon pile. Resistance wire. Liquid rheostats. Design of the resistor, ohmic value, capacity, and stepping.

Control Systems and Methods of Control—Voltage, current, and time-limit methods of control. Motor acceleration and deceleration and methods of braking. Speed control by field resistance, armature resistance, secondary resistance, and primary resistance. Protective requirements and devices.

Controller Applications—General conditions in each of various classes of controller service. Machine tool controllers, light and heavy machinery, steel mill, hoist, crane, bridge, elevator, traction service.

Operation and Maintenance—Installation of controllers. Duties of the operator. Duties of the maintainer. Inspection. Replacements and adjustments. Cleaning.

Wiring Diagrams—Approved symbols and diagrammatic representations. Tracing circuits. Analyzing a diagram. Main circuit diagrams. Control circuits. Reading the complete diagram. Practice in reading.

Electric Illumination

(EE-3x)

The man who handles illumination must know how to test existing installations, how to determine the improvements necessary, and how to select the means to obtain that betterment. He must also be able to plan extensions and other new work. This course covers the common applications of lighting industrial plants, stores, and residences, and touches upon street lighting. Factory managers who desire utmost efficiency from their workmen, merchants who sell lighting fixtures and supplies, and building contractors will find this training profitable. Chief electricians, for instance, also will find the practical problems exceptionally enlightening.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

TRIGONOMETRY (Ma-4) — Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

ELECTRIC ILLUMINATION (EE-10)—**Wiring for Illumination**—Materials. Selection and installation of inside and outside wiring systems. AC and DC calculations.

Illumination Principles—Fundamental concepts of light and illumination. Photometers, their principles and uses. Candle-power distribution curves of lamps and of lighting units. Field methods of measuring illumination.

Lamps—Vacuum and gas-filled types of incandescent lamps. Operating characteristics. Influence of burning position and voltage variation. Available sizes. Mercury vapor lamps. Arc lamps of various types.

Reflectors and Enclosing Glassware—Direct, semi-indirect and indirect. Service requirements and approximate types of reflectors for various uses. Relative efficiency and comparative characteristics of steel, opal glass, prismatic glass and mirrored glass reflectors for various types of lighting installations.

Illumination Design—Proper diffusion of light and means for securing it. Shadows. Reflecting properties of various surfaces. Proper illumination values for various classes of lighting service. Coefficients of utilization. Depreciation factors. Selection of proper lighting systems for various types of service. Determination of the number, location, and type of lighting units. Typical examples and calculations.

Types of Lighting Service—Industrial plants. Offices. Drafting rooms. Stores and store windows. Auditoriums and schools. Residence lighting. Street lighting. Electric signs. Flood lighting.

Lighting Specifications and Contracts—Essential parts. Responsibilities and obligations of parties. How to write up specifications and contracts. Incorporation of plans and diagrams in contracts and specifications. Examples of typical lighting specifications.

Automobile Headlighting — The two main classes of driving conditions and the headlighting requirements of each. Light distribution on the road. The specifications for the model headlamp and rules for its adjustment as formulated by the Illuminating Engineering Society and the Society of Automotive Engineers. Approved equipment available at the present time. Maintenance, adjustments and care.

Maintenance of Illuminating Systems—Depreciation in service of lighting units and reflecting surfaces. Modern methods of maintaining efficiency. Replacement of lamps. Refinishing reflecting surfaces. Method of laying out cleaning schedule.

The world is demanding, as never before, men of good character with well-developed minds—minds ready for specialized work, for bigger jobs. The United Y.M.C.A. Schools teach the very subjects you should study in order to get ahead.

Electric Wiring

(EE-11x)

In this course the needs of the wireman are treated fully. Every electrical worker must know the elements of electricity and magnetism before he can do intelligent work. These elements form the first step in this course, and interior wiring for light and power form the main part. Practical methods used in actual installations are carefully considered throughout.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ELECTRIC WIRING (EE-8) — **Fundamental Principles** — Sources of electrical energy. Voltage. Current. Resistance. Ohm's law. Power. Simple series and parallel circuits and combinations of series and parallel circuits. Magnetism. Permanent magnets and electromagnets. Magnetic circuits.

Wire—Conductors and insulators. Wires and cables. Methods of manufacture. Properties and kinds. Wire gauges and tables. Code specifications. Installation according to code requirements. Joints and splices.

Wiring Material—Switches. Circuit-breakers and fuses. Sockets and receptacles. Panelboards and switch-boards. Construction of rigid and flexible conduit. Conduit sizes. Fittings. Outlet boxes. Underwriters' approval. Wireman's tools and methods.

Wiring Systems—Open wiring. Knob and tube. Rigid conduit. Flexible armored cable. Metal and wooden moulding. Underwriters' requirements and inspection. Municipal ordinances. Rules of local power companies. Grounding. Selection of the wiring system for a job. Costs. Fire risk and mechanical protection. New or finished buildings. Wiring for unusual conditions. Methods of installing each system.

Circuits—Two- and three-wire DC circuits. Balanced and unbalanced three-wire systems. When to use three-wire system. Determining the load on a circuit. Code requirements regarding the loading of circuits. Determining the size of wire to meet requirements. Single phase and polyphase AC circuits. Two- and three-wire single phase circuits. When, where, how, and why to ground circuits. Laying out circuits for new and old buildings. Power and lighting circuits. Calculation of DC and of AC circuits.

Direct Current Apparatus—Principles, construction, and operation of generators and motors. Shunt, series, and compound machines. Locating and correcting troubles. Starters and controllers. Motor connections.

Alternating Currents—A brief treatment of the fundamental principles of alternating currents and alternating current motors. AC starters and controllers. Locating and correcting troubles.

Electric Illumination — Fundamental concepts of light. Illumination measurement. Reflectors and enclosing glassware. Principles of illumination design. Lighting systems. Location of lighting units. Practical methods of laying out interior illumination systems. Typical installations. The foot-candle meter.

Miscellaneous—Selecting motors for various requirements. Batteries and battery wiring. Annunciator and other signal wiring. Distribution lines. Construction. Voltages. Safety precautions.. Contracts and specifications. Writing up your own specifications. Making estimates.

Storage Batteries

(EE-5x)

The storage battery finds a wide range of usefulness because it is a convenient source of energy. It is used extensively in central power stations; in telegraph, telephone and wireless service; and as the prime mover or auxiliary power source in various methods of transportation.

The storage battery enables the modern automobile to give the remarkable service which the car owner expects of it as a matter of course. The service man is a battery surgeon, and his work calls not only for accurate and detailed technical knowledge, but for intelligence and judgment of a high order. A battery man who really understands the needs of the storage battery and has the knowledge and skill to treat its failings properly never has to go out looking for business for it will come to him.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

STORAGE BATTERIES (EE-8) — **Construction of Batteries**—Manufacture of battery parts. Types of plates. Types of batteries. Assembly operations. Methods of shipping.

Electrochemical Principles—Chemical actions in the battery on charge and on discharge. Voltage changes on charge and discharge. Changes in the density of the electrolyte. Capacity of batteries.

Operation and Maintenance—Methods of charging. Charging equipment. Operating temperature range. Causes and effects of heating. Care of the battery. Battery rooms in standby and other service. Care of idle batteries.

Repair—Battery troubles and their remedies; the extensive treatment of this subject is arranged under the various battery parts. Repair shop equipment and methods. Various shop tests.

Battery Service—Types of batteries, installation, and operating conditions in ignition and starting, vehicle, standby, farm and country home lighting, and other service.





H. H. KETCHAM

RADIO telegraphy, which is now one of the important factors in the economic life of the world, has revolutionized communication. Nations that were formerly geographically isolated are now in close relationship with the rest of the world. World markets have been made accessible to the most distant manufacturer. Ships that formerly sailed across the seven seas unprotected, are now watched and guided in their progress by the use of the wireless. If in distress, the news will be flashed in all directions, often preventing grave disaster.

But the use of the wireless principle does not stop here. The inventive genius of man has made possible and practicable the use of a radio telephone in an isolated farmhouse or in a metropolitan dwelling. The radio telephone brings the world to the listener's ears. This marvelous invention that has already opened up a tremendous field of activity is still in the embryonic stage. Its future importance can be measured by past performances. Although radio communication is comparatively young, it ranks with the telephone and telegraph in importance.

The radio man is among the best paid of electrical workers. From the operator at $100 or more a month with free board and lodging to the radio engineer at from $2500 to $10,000 and more a year, salaries are consistently high. Few fields of endeavor offer more opportunities for fascinating and creative work with good remuneration. The capable radio man is seldom out of a job and his chances to grow are limited only by his own ability and perseverance. As new uses are found for wireless communication, the demand for radio experts will increase and salaries will increase in proportion.

Instruction by Experienced Men

The instructors of the Radio Engineering Department are well fitted for their respective positions, both by practical experience and education. H. H. Ketcham, EE., the head of this department, is a man of broad experience and education. After graduating from Lehigh University he spent ten years in the practical engineering field. He is an associate member of the American Institute of Electrical Engineers and a member of the American Association for the Advancement of Science. Assisting Mr. Ketcham in the instruction work is N. S. Dickinson, a graduate of Union College, who has had ten years' experience in the teaching and practice of engineering. He has occupied such positions as head of the Electrical Department of the Newark Technical School, instructor in Radio Officers' School at Columbia University and consulting and designing engineer in industrial work. Another able assistant is H. T. Hoot, B Sc., graduate of Rutgers College; six years' experience in mechanical and electrical, industrial and research work, including illuminating engineering and radio telegraphy and telephony; junior member American Society of Mechanical Engineers.



N. S. DICKINSON

Radio Operating

(Ra-1x)

The man desiring to enter this profession and make it his life's work and the thousands who want to enjoy the entertainment and diversion offered by this interesting work will find this course of value to the attainment of their ambitions. Radio operating is covered with a thoroughness that equips the student for a license as a commercial radio operator.

Topics Covered in This Course:

RADIO OPERATING (Ra-2)—**Electricity and Magnetism**—Magnets. Electromagnetic induction. Production of electromotive force. Ohm's law. Electric generator. Alternating current phenomena. The transformer. Electrical measuring instruments.

Dynamo-Electric Machinery—The motor-generator. The dynamotor. The rotary converter. Speed and voltage control. Manual and automatic starters. Protective devices. Maintenance of dynamo-electric machines.

Principles of Radio Communication—Electrical resonance. Oscillatory circuits. Radiation of electromagnetic waves. Wave length and decrement of circuit. Methods of excitation. Reaction of coupled circuits. Complete circuit for damped wave transmitter.

Radio Transmitting Apparatus—Spark dischargers. Open and closed oscillatory circuits; apparatus and its adjustment. High voltage transformers. Aerial transfer switch.

Radio Receiver—Principles of reception. Methods of coupling. Types of simple detectors. The three-electrode vacuum tube as a detector and as an amplifier. Standard receiving circuits.

Auxiliary Radio Equipment—Statute requirements. Induction coil transmitters. Construction and operation of lead-acid and alkali types of storage battery. Study of battery charging panels.

Radio Measurements — Resonance indicators. The wave meter. The hot wire meter. The decremeter. Instruction for tuning a radio transmitter. Measurement of inductance and capacity. Audibility meter.

Modern Radio Installations—Study of standard equipment of Radio Corporation of America; Simpson; Cutting and Washington; Independent Wireless Telegraph Co. The Alexanderson high frequency alternator. Poulson arc. Goldschmidt radio frequency alternator. The vacuum tube as an oscillation generator. Radio telephone.

Radio Communication Laws—Study of latest U. S. regulations governing ship and land stations. Station and operator's licenses. General information.

Radio Accounting and Message Procedure—Classes of radiograms. Charges. Abstracting. The radio log. Sending, receiving, and relaying of commercial and service messages.

Radio Engineering

(Ra-2x)

To the ambitious man this course offers unusual opportunities in a new and growing field. It furnishes him with a knowledge of radio engineering that will fit him to perform the duties of inspector, instructor, radio aid, radio draftsman, or radio engineer.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction to deal with formulas and equations that occur later in the course. Graphs and how to make them.

GEOMETRY (Ma-2)—Explanations, problems and calculations having to do with plane surfaces and solids. Simple formulas and their use. Graphic methods.

TRIGONOMETRY (Ma-4) — Logarithms and how to use them. Engineering problems where logarithms must be used and also problems where it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

ELECTRICITY AND MAGNETISM (EE-5)—**Electricity**—Sources of electromotive force. Current. Resistance. Ohm's law. Units. Circuits. Power.

Magnetism — Magnetic phenomena. Electromagnetism. Reluctance. Permeability. Hysteresis. Electromagnetic induction.

Direct Currents—Types of dynamos. Principles. Characteristics, construction and operation of DC generators, motors and control apparatus. Motor applications.

Alternating Currents—(Preliminary study)—Principles of alternating currents. The alternator. AC motors. Control apparatus. Transformers.

Electrochemistry—Primary batteries and storage batteries. Electrolysis. Some principles of general chemistry.

Miscellaneous—Electrical measurements and measuring instruments. Electrical distribution. Illumination.

MECHANICAL WORKING DRAWINGS (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

STORAGE BATTERIES (EE-26)—Construction of storage batteries. Chemical actions in the battery on charge and on discharge. Voltage characteristics. Density of electrolyte. Capacity of batteries. Methods of charging. Charging equipment. Operating temperature range. Causes and effects of heating. Care of the battery. Portable batteries. Care of idle batteries. Battery troubles and their remedies.

RADIO ENGINEERING DRAFTING (Ra-8)—Lesson notes and blueprints supply the instruction data needed for each drawing.

Motor Drawing—Complete assembly and detail drawings of a standard electric motor. Projections. Dimensions. Standard conventions.

Wiring Plans and Diagrams—Conventional symbols. Typical diagrams used by representative electrical manufacturers, both direct current starters and controllers and alternating current starters and controllers. Standard symbols for wiring plans. Typical plans.

Radio Drawings — Wiring diagram of radio units. Detail and assembly drawings of radio apparatus. Design of radio units.

MECHANICS (CE-11)—Components of forces. Resultants of forces. Equilibrium of forces. Law of sines. Parallel forces. Center of gravity. Moment of inertia. Machines and laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

ADVANCED ALGEBRA (Ma-25)—A thorough study of the algebraic principles most useful and helpful to the practical man.

ANALYTIC GEOMETRY (Ma-24) — Selected lessons treating of the relation between the equation and the graph. This subject is particularly helpful in the field of engineering.

***ALTERNATING CURRENTS** (EE-6)—**Principles of Alternating Currents**—Frequency. Inductance. Inductive reactance. Capacitance. Capacitive reactance. Impedance. Power and power factor. Vector diagrams. The electrical degree. Electromagnets. Electromagnetic induction.

AC Circuits—Current and voltage relations in series and in parallel circuits. Relation of resistance, reactance and impedance. Single phase circuits. Polyphase circuits. Delta and Y connections. Current and voltage relations in the line and in the load. Power relations. Power measurement.

Wiring Calculations—Single phase and polyphase circuits. Inductive and non-inductive loads.

Transmission and Distribution—Modern systems. Modern practice in voltages. Stations. Sub-stations.

AC Machinery—Principles and parts of alternators, synchronous motors, induction motors, series motors, synchronous converters, rectifiers, transformers and control apparatus.

Operation of AC Machinery—Installation, care and operations of transformers, alternators and synchronous motors, induction motors, synchronous converters, mercury-arc rectifiers. Vibrating rectifiers. Vacuum tube rectifiers.

DIRECT CURRENT DYNAMO-ELECTRIC MACHINERY (EE-2)—Permanent and temporary magnets. Magnetic flux and flux density. Magneto-motive force. Reluctance. Magnetic circuits. Electro-magnetism. The solenoid. Magnetic properties of iron and steel. Hysteresis. Electromagnetic induction.

The DC Dynamo—The armature. The commutator. The frame. Field poles and yokes. Field windings. The magnetic circuit. Field excitation. Leakage. Saturation of parts. Laminated parts. Principles of generator operation. Characteristics of shunt, series, and compound machines. Parallel operation. Starting and stopping. Care of generators. Elements of commutation and factors affecting it. Principles of motor operation. Motor starters and controllers. Service requirements. Switchboards and accessories. Protective devices. Installation of motors and generators.

***CALCULUS** (Ma-8)—A simple and direct treatment of both branches of the calculus applied to problems in radio engineering. Many interesting problems discussed.

RADIO ENGINEERING (Ra-1)—**Fundamental Considerations**—Nature of the electric field. Electron theory. Radiation of energy. Study of oscillatory discharge of condenser. Resonance phenomena. Methods of coupling oscillatory circuits. Decrement of waves in oscillatory circuits.

Antenna Systems—Theory of radiation. Closed and open circuit oscillators. Constants of antenna system. Transmission factors and formulæ. Directional characteristics. Practical construction.

Damped and Undamped Wave Telegraphy—Transmitter circuits and their operation. Receiving circuits. Factors affecting the reception of signals. Interference considerations. Heterodyne reception.

The Three-Electrode Vacuum Tube—Study of hot-cathode electron emission in vacuo. Fundamental rectifying properties. Action of the third electrode. Theory of operation of tube as detector, amplifier and oscillator. Regenerative circuits. Application of tube as oscillator for transmission.

Radio Telephone—Fundamental problems. Methods of modulation. Methods of reception. Speech distortion. Multiplex radiophone.

Directional Antennæ—Principles. Loop antenna. Radio goniometry. Reduction of interference.

Miscellaneous Applications of Radio Circuits—Submarine service. Aeroplane service. Various special applications.

* *Optional.* (*See Page* 12.)

Personal Service by Instructors Better than Textbooks

Your corrections of my lessons have taught me more how to figure out these problems than the books would, for you explain more clearly the way to do it. I appreciate your consideration very much.—CHAS. W. WAMBOUGH, Trenton, N. J.

Appreciates the Quality of the Textbooks

The books you sent were fine. They cover the subject of Radio Telegraphy from A to Z and they are very interesting, something rather unusual in textbooks.—D. H. HOLDER, Pine Bluffs, Ark.

In the Long Run Trained Heads Win



THE nation's greatest wealth is its agriculture. In no country in the world is there so much good land or such a varied agricultural opportunity as exists in America. And yet, in spite of our modern machinery, the yield of our soil is poor as compared with that of many European countries. The drift toward the cities has undoubtedly reached its limit. The high cost of city rents and food, and the great improvement in living conditions in rural communities, brought about by telephones, automobiles, good roads, and other conveniences formerly enjoyed only in the cities, make it obvious that the "back to the farm" movement talked of for years, is at hand.

Fortunately there is now, and probably will be for some years, an ample supply of good land that can be had at reasonable prices—land where a young man may erect and own his little kingdom where there is healthful sunshine, pure invigorating air, and good surroundings for his family; where he can be a more contented and more useful citizen, and where he can have the satisfaction of enjoying the fruits of his labors.

The day of haphazard farming is passing. Trusting to luck and guesswork, or following out-of-date methods is to live in the rut of a hand-to-mouth existence. The modern farmer with progressive ideas and the proper high conception of his vocation conducts farming as a science, as a profession, and as a business—all of which require specific knowledge and technical training.

It is needless to say that the best possible preparation a young man should have for the pursuit of an agricultural career is a reasonable amount of practical farming experience. However, this is not absolutely necessary, and the man who is thoroughly interested in any phase of farming work has a wealth of valuable instruction within his reach. Perhaps the strongest of all arguments for studying agriculture by correspondence is found in the work of the United States Department of Agriculture. Though the Department lays out no formal courses of study, gives no reviews and affords no special service to students of modern farming, its collected data and the results of its experimental work are finally put into printed form and sent out through the mails.

The greatest assistance given in the courses of study offered by the United Y.M.C.A. Schools is the combining of the choicest data we have been able to secure from the best textbooks and authorities in the United States into a practical modern course, whose value is enhanced by capable instruction. When the student follows his course to completion, he should have a comprehensive, workable knowledge of the subject, which he can put to immediate use.



C. B. DOW

Instruction by Experienced Men

At the head of the Agricultural Department is Mr. C. B. Dow, a graduate from the University of Vermont and State Agricultural College. His connection with farming, both practical and technical, dates from the high school age when he was an able assistant in the management of a large estate where he lived. At the outbreak of the war when the need of men in agricultural lines became acute, Mr. Dow was sent to the Farm and Trades School in Boston as Instructor of Agriculture and Farm Manager. After serving a year and a half in this capacity, he was enlisted in the Army as an Instructor of Agriculture in a Development Battalion. Mr. Dow is assisted by capable instructors whose training and experience are of great aid to the student.

Farm Management

(Ag-3x)

Farm management is concerned with each individual phase of farm work and the relationship that it bears to the whole farm and to other outside enterprises that influence the profits. To be successful requires good judgment, practical experience and a knowledge of the underlying principles of farming. These facts are impressed upon every student throughout the entire course. The most simple and practical plans that can be used are fully discussed in such a clear-cut manner that they are easily understood and applicable to every-day farm work. The course also shows the farmer how to sell his crops most profitably.

Topics Covered in This Course:

FARM MANAGEMENT (Ag-6) — **Types of Farms**—Examples of influence of climate, soil and topography. Relation of transportation to type of farming. Personal factor. Diversified and specialized farming. Seasonal distribution of labor. Diversified farming on dairy farms. Successful types of farming. Intensive farming. Extensive farming.

Maintaining Fertility of Land—Decreasing of crop yields. Ways in which productivity may be decreased. Maintaining the organic matter. Maintaining the nitrogen and mineral supply. Methods of handling manure.

Live Stock Problems—Amount of live stock to keep. Feeding animals. Animal records. Relation of size of animal to efficiency. Depreciation on live stock. Increasing value of young stock.

Farm Organization—Size of farms. Capital. Methods of renting land. Man labor. Horse labor. Substitution of engines for horses. Farm equipment. Farm arrangement. Pastures and fences. Farmstead. Garden. Farm buildings. Cropping systems.

Business Methods—Kinds of accounts. Accounts with persons or firms. Annual inventory. Receipts and expenses. Miscellaneous accounts. Cost accounts. One or more crops. Kinds of animals. Details of cost accounting and other methods of accounting, and principles involved.

Marketing of Farm Products—Fundamentals of marketing. Methods of sale. Function and organization of wholesale produce trade. Sale by auction. Cost of marketing. Cold storage. Transportation as a factor in marketing. Prices of farm products. Produce exchanges. Future trading. Inspection and grading. Types of markets. Problems of retailing.

Farm Crops

(Ag-8x)

Undoubtedly many of the most important features of farm crops are often overlooked by the majority of farmers. This results in consequent losses to themselves and to the country, for the business of raising crops has not progressed as rapidly as it should have to meet the ever growing needs of our increasing population. It is the object of this course in discussing each of the important crops of our country to consider carefully every factor that is primarily responsible for increased production. From the preparation of the soil to the selling of the crop, all points are taken up in logical order and explained in a way that makes them adaptable to existing conditions.

Topics Covered in This Course:

FARM CROPS (Ag-7)—**Fundamental Principles**—Classification, origin and distribution of field crops. How plants grow. Production of seeds.

Corn—Comparative study of cereals. Cropping systems. Raising of corn. Climate and soil required. Preparation of land. Tillage. Harvesting and utilizing corn. Corn insects and diseases. Popcorn. Sweet corn. Corn judging.

Grains—Origin and description of wheat types. Wheat culture. Harvesting, marketing and utilizing wheat. Diseases and insect enemies of wheat. Production of oats. Culture of oats. Harvesting and utilizing the oat crop. Production of barley. Rye production. Buckwheat production. Sorghum.

Fibril Plants—World production of cotton. Cotton culture. Importance of flax crop. Culture of flax.

Vegetables—Culture of Irish potatoes. Harvesting of Irish potatoes. Culture of sweet potatoes. Harvesting of sweet potatoes. Beans. Peas. Peanuts.

Grasses—Characteristics of economic grasses and legumes. Grass mixtures. Care of grass. Principal cultivated grasses. Secondary grasses. Millets. Legumes. Alfalfa. Clovers.

Tobacco—Production. Culture. Care of plants. Fertilizer. Cultivation.

Now Solves His Farm Problems in a New Way

I have found your course in Farm Management very beneficial. It has opened up new lines of thought and new methods of handling farm problems.

—JOHN W. LIPSCOMB, Lockhart, Tex.

Agricultural Chemistry

(Ag-11x)

Every farmer is primarily interested in increased crop and animal production, but very often loses sight of the chemical aspects of his operations, due chiefly to his lack of knowledge that they contain the underlying principles of his success or failure. The knowledge of the properties of his soils, fertilizers, feeds, water, etc., and their proper application is essential to every farmer's prosperity and is a valuable asset. Information given in this course could never be obtained from practical farm work alone, but once it is secured and used in working out the problems of every-day farming, then only will the "why" and "wherefore" of each phase of the business be really appreciated.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

AGRICULTURAL CHEMISTRY (Ag-2)—**Principles of Chemistry—Elements.** Atomic weights. Molecules. Symbols. Molecular weights. Oxidation. Reduction. Compounds. Mixtures. Valence. Formulas. Equations. Acids. Bases. Salts. Anhydrides. Dissociation. Nomenclature.

Elements in Plant Growth—Oxygen. Nitrogen. Hydrogen. Carbon. Phosphorus. Sulphur. Potassium. Calcium. Magnesium. Iron. Forms of plant food.

Water—Properties of water. Solvent action of water. Availability of plant food. Drinking water. Hardness in water. Filtered water. Boiled water. Distilled water. Water requirements of plants.

Soils—Air in soils. Formation. Composition. Fertility.

Fertilizers—Animal manures. Agricultural lime. Mixing of fertilizers. Calculation of formulas.

Animal Nutrition—Classes of foods. Calculation of rations. Corn. Oats. Barley. Dried brewer's grain. Other grains. Cereals. Vegetables.

Milk and Its Products—Preservatives. Testing. Babcock test. Specific gravity. Butter. Cheese. Condensed milk.

Insecticides, Fungicides, and Disinfectants—Classification of insects. Control methods. Spray materials and application.

Paints and Whitewashes—Paints. Oils. Driers. White pigments. Colored pigments. Mixing paints. Whitewashes. Calcimine. Varnishes. Shellac. Glue.

Soils and Fertilizers

(Ag-4x)

Until recent years little attention has been given to the scientific use of the nation's greatest wealth—the soil. Today, however, we find that men are studying and finding out how to handle their soils so the land will produce exceptionally fine crops and yield satisfactory profits. This is a course that all who are agriculturally inclined should study, for success or failure is generally attributed to the handling of the land and the selection and raising of crops.

The material benefits of this study will be readily apparent when crop yields are increased and final returns are in many cases doubled due to an actual and workable knowledge of the value of manure, humus, soil bacteria, crop rotation and the conservation of plant food and moisture.

Topics Covered in This Course:

SOILS AND FERTILIZERS (Ag-11)—Soils. Classification. Origination. Composition. Economic factors.

Soil Fertility Factors—Soil. Water. Land drainage. Irrigation. Silt. Tillage. Soil organism.

Soil Management—Seeding. Planting. Cultivation.

Soil Improvement—Crop rotations and crop systems. Soil erosion. Marsh soils. Sands, clay and depleted silt loams. Relation to farm management.

Fertilization—Green manure crops. Commercial fertilizers. Home mixture of fertilizers. Farmers' and fertilizers' lands. Back-yard manure arrangement. Use of fertilizers. Application and appliances used for all fertilizers. Lime as a supplementary constituent.

Vegetable Gardening

(Ag-10x)

People of all classes in our towns and cities and on our farms have become intensely interested in gardening. In many cases this work is undertaken as a means of reducing household expenses, or as a business proposition by the production of truck for sale. Fresh vegetables of high quality may not be obtainable even though the cash is available for the exorbitant prices demanded, and a garden in the back-yard helps to solve this household problem. The

farmer, city man, or truck gardener will find that this course will meet his individual needs and give him a practical working knowledge of the planting, cultivating, harvesting, packing, marketing, and selling of his crops.

Topics Covered in This Course:

VEGETABLE GARDENING (Ag-4)—**Types of Vegetable Growing**—Market gardening. Truck farming. Growing vegetables for the cannery. Home vegetable gardening.

Principles of Vegetable Cultivation—Soil and location. Factors influencing the quality of vegetables. Seed supply. Plant food supply. Moisture supply. Temperature factor. Transplanting. Use of glass in vegetable growing. Preparation of soil for planting. Planting of seeds. Controlling insects and diseases that attack vegetable crops.

Classification of Vegetables—Cool season crops that quickly reach edible maturity. Transplanted crops that mature before the heat of summer. Late cabbage and similar crops. Onions. Potatoes. Beans. Sweet corn and other crops of similar cultural requirements. Vine crops. Warm season crops that require transplanting.

Marketing and Harvesting—Care of vegetables between harvesting and marketing. Packing sheds. Preparation of vegetables for market. Selling the crop. Storage for winter use.

Productive Orcharding

(Ag-5x)

A realization of the value of our apple crop is self-evident when we consider that this crop returns 90% of the value of pome fruits and 60% of the total income secured from all orchard fruits.

Never has there been so great a demand for orchard products as at the present time. It is with this fact in mind that the methods of variety, selection, cultivation, fertilization, spraying, harvesting, grading and other important phases of orcharding are discussed. The business of fruit growing is highly profitable if it is thoroughly understood and the proper methods are carried out.

The course is arranged by a presentation of each phase of fruit growing in the most logical and comprehensive manner and in a brief yet complete form so that it is easily applied to the farm orchard of any size.

Topics Covered in This Course:

PRODUCTIVE ORCHARDING (Ag-10)—**Outlook for Orcharding**—As an occupation. Over production. Insects. Diseases. The right man.

Planting and Culture—Orchard lands. Selecting varieties. Buying nursery stock. Establishing the orchard. Propagation. Cropping the orchard. Orchard culture. Orchard implements. Fertilizers.

Care of Orchard—Cover crops. Pruning. Orchard insects. Diseases of fruit trees. Spraying apparatus. Spraying materials. Spraying campaign. Renovating old orchards.

Marketing Crop—Picking and handling fruit. Storing fruit. Grading and packing. Marketing. Advertising.

Laws Affecting Orcharding—Local administration. National laws. Canadian laws and regulations. United States laws. Fruit standardization. Regulating commission merchants.

Farm Forestry

(Ag-2x)

How many farmers pay as much attention to their woodlot as to the crops which they raise? When properly established and cared-for there is an attractive profit in the farm woodlot. It is the purpose of this course to aid the student in discovering the best ways and means to make money from this usually neglected source. The instruction is practical and easy to understand. It is designed for every-day use on the farm.

Topics Covered in This Course:

FARM FORESTRY (Ag-3)—**The Farm Woodlot**—Place in farm management. Capabilities. Location. Clearing a farm.

Botany of Woodlot Trees—Description. Habitat. Classification. Value. Use. The farm nursery. Regeneration of woodlots. Tree plantings.

Farm Woodlot Management—Thinning. Forest protection. Mensuration. (Finding the area of a woodlot by use of an ordinary compass.) Forest utilization. Sogging. Skidding. Felling. Timber estimation. Cordwood measurements.

Products and By-products of the Woodlot—How to make maple sugar. Preservation of woods.

Forest Influences—Effect on land. Run-off of water. Evaporation.

Rules, Laws, Tables.

Spare-hour education is offered by the United Y.M.C.A. Schools on the platform of: (1) *the most service for the least money;* (2) *careful guidance in the choice of a course for every applicant;* (3) *the personal interest of a competent and sympathetic teacher;* (4) *as much encouragement to complete a course as to begin one.*

Dairying

(Ag-9x)

This course deals with information that has been worked out by long experience in dairy regions and clearly demonstrates that the most important source of income of American farmers is dairy farming. The vast amount of information regarding dairying has been arranged in a compact and useful manner, including discussions of all up-to-date methods and machinery which have proven to be of practical and financial value to the industry.

Topics Covered in This Course:

DAIRYING (Ag-5) **Dairy Breeds**—History. Origin. Characteristics. Relative importance of breeds. Starting a dairy herd.

Care and Management of Dairy Cows—How to milk. Feeding (winter and summer). Dairy barns. Common ailments of cattle, and remedies. Computation of rations. Calf raising.

Milk—Production and handling. Certified milk. The farm milk house. The Babcock test. Market milk. The use of the lactometer. Grading and selling. Standards of purity.

Dairy Products—Cream separation and separators. Ripening cream. Butter making and marketing. Dairy and cottage cheese. Ice cream manufacture and formulas.

Breeding and Feeding of Livestock

(Ag-7x)

To make a farm productive and profitable the economical feeding of farm animals is imperative, and to accomplish this result a knowledge of the value to be had from any feed is only obtainable by knowing something of the composition of feeds, the product produced, and the factors that affect the value of a feed. Each class of animals demands a different treatment in care, management, feeding and breeding. This course is arranged to meet these requisites in a most comprehensive and practical way, so that it is readily applicable to the every-day needs of stockman or farmer.

Topics Covered in This Course:

BREEDING AND FEEDING OF LIVESTOCK (Ag-8)—**Horses**—Breeds. Judging horses. Principles of feeding. Feeding the horse. Care and management of horses.

Cattle—Breeds of cattle. Feeding dairy cattle. Food requirements for milk. Care and management of dairy cattle. Sanitary milk. Dairy barn. Feeding beef cattle. Care and management of beef cattle.

Sheep—Breeds of sheep. Judging sheep. Feeding sheep. Fattening sheep. Care and management of sheep.

Swine—Breeds of swine. Judging swine. Food requirements of swine. Feeding of swine. Fattening swine. Care and management of swine.

Poultry—Breeds of poultry. Judging poultry. Essentials of feeding poultry. Feeding for meat production. Feeding for egg production. Care and management of poultry.

Economic Disease and Insect Control

(Ag-6x)

The great losses sustained by the depredations of fungus, insect, and disease enemies of our farm, garden, and orchard crops, have reached high figures, and it has become necessary to understand thoroughly the essential points of their proper control if we are to secure greater and more economical yields. By study of the causes of and cures for destructive pests a world of information is opened to the farmer. It results in supplying him with valuable assistance in combating the forces that damage his crops and reduce his profits.

Topics Covered in This Course:

ECONOMIC DISEASE AND INSECT CONTROL (Ag-9)—**Insects**—Injury to crops by insect pests. Beneficial insects. Predaceous and parasitic insects. Structure and development of insects. Farm methods for the control of insects.

Insect Control—Paris green. London purple. Arsenate of lead. Arsenite of lime. Insecticides. Atomizers. Bucket pumps. Compressed air sprayers. Knap-sack pumps. Barrel pumps. Other spraying apparatus.

Insects Injurious to—Grains. Vegetables. Fruit. Berries.

Delighted with Productive Orcharding Course

I have just completed your Productive Orcharding Course and have been delighted with every lesson. The course throws light on the dark spots of orcharding in a most pleasant and fascinating way.—SILAS C. HANSEN, 4926 Kinzie St., Chicago, Ill.

Study Will Bring You Increased Profits

POULTRY HUSBANDRY

(Ag-1x)



THOMAS F. MCGREW

IN the annual value of its products, poultry husbandry ranks as one of the leading agricultural specialties of America. It is frequently referred to as "the billion dollar industry," and its importance in our economic life is rapidly increasing. Figured in dollars and cents it is truly "big business," yet a business in which anyone controlling a small area of vacant land, or even a roomy back yard, can have a part. From such small beginnings many of America's greatest poultry farms have grown in a comparatively short time.

Whether you are a spare-time poultry man or woman, or a fancier of fine "birds" or a farmer owning a few fowls, this course will give you the scientific knowledge that will insure your success in the raising of chickens and the production of eggs. The knowledge and experience of the foremost poultry experts of this country and Canada are written into this excellent course to give the student a most complete and comprehensive education in poultry husbandry.

Instructors

This course was written by Harry G. Forster, assisted by such other eminent poultry authorities as Prof. Frederick H. Stoneburn; Prof. F. C. Elfort, Dominion Poultry Husbandman; M. L. Chapman, General Manager of Wilburtha Poultry Farms; and John S. Martin, B.A., Member of Board of Directors, American Poultry Association.

Thomas F. McGrew, who has personal supervision of the work of the students, is exceptionally well fitted for this important work. He has an international reputation as a poultry authority, having devoted a long and active life to the betterment of the industry. He has made a big success as a poultry fancier and breeder, a poultry judge, a writer and editor, and the author of standard poultry bulletins and textbooks.

Topics Covered in This Course:

POULTRY HUSBANDRY (Ag-1) — **Poultry Business**—Past, present, and future. Personal qualifications for success. Possibilities and importance of poultry business. Why women are successful with chickens. Why farmers are successful. Value of experimental stations. Survey of poultry conditions and chances for success.

Discussion of Breeds—Popular fowls illustrated and discussed. Advantages and drawbacks of each breed. Parts of fowl's body discussed. History of breeds. Fancy and utility fowls.

Housing Problems—Houses for various parts of country. Laying, breeding, brooding, and other quarters. Plans for poultry houses. Moisture and ventilation problems. Foundations, floors, roofs, etc. Egg room. Incubator cellar. Work quarters.

Artificial and Natural Incubation — Care of hatching eggs. Selection of hatching eggs. Care of incubators. Care of setting hen. Coal, oil, gas, and electric incubators. Advantages and drawbacks of hatching devices.

Care of Chicks—Under hens. Types of brooders. Feeding and care of chicks with hens, with brooders. Feeding schedules. Regulation of brooders.

Care of Growing Stock—Proper range. Feeding growing stock. Interior sanitary precautions. Care of breeding fowls and of capons. How to feed broilers. Fattening formulas.

Care and Selection of Breeders and Layers—Care and feeding of layers. Handling of nervous breeds. Care and selection of breeders. Mating breeds. Insuring strong chicks.

Artificial Lights for Poultry — Methods of using lights. When to use lights.

Back Yard Poultry—Methods of keeping poultry in back yards. Kind of stock and how to buy. Selling problems.

Marketing—Selling to hotels, high-class groceries, hospitals, etc. How to pack and ship eggs and poultry. Mediums for advertising. Writing advertisements.

Poultry Costs—How to figure production costs of poultry and eggs. Daily, weekly, monthly and yearly accounts.

Poultry Diseases—All diseases studied. Latest vaccine treatment. How to keep poultry free from disease. Bad habits, prevention and cure. Special expert to answer questions.

Don't be a mental midget or just the "general run" of man. Scientists declare that the mind of the "general run" of man grows very little after he is eighteen or twenty years old.



FARMING, the greatest and most important of all American industries, has in recent years been marked with the indelible stamp of progress. From a haphazard pursuit of uncertain results it has developed into a modern scientific profession. Many labor and time saving inventions, and the knowledge gained by years of careful research, are now placed at the command of the farmer. He can run his farm on a scientific basis that will insure the best results. He can at the same time enjoy living comforts equal to those of the modern city home.

From the experience and research work of others it is possible to locate the various outbuildings of the farm so that the farmer can carry on his operations with the greatest facility. Practically every farm operation, whether plowing, planting or reaping, is now done by machinery that has supplanted human labor. In place of the ox, the mule or the horse, tractors now do the work of ten animals in half the time. To know these various pieces of machinery so necessary to modern and efficient farm operation, and how best to maintain them, will save the farmer a great many dollars. But progress does not stop there.

Science has taught the modern farmer how best to utilize the natural resources of his land. It has given him many conveniences. It has transformed the rural home from a condition of isolation to one of town advantages. The water of the brook or stream that has for centuries past flowed peacefully onward undisturbed by the hand of man, can now be harnessed to work. Not only will it irrigate arid lands, but it will furnish power that turns the wheels of labor. It will give the power for heat and light. By mechanical means water can be brought to the kitchen, the bathroom, or any other part of the farm, giving the farmer urban conveniences that, with the telephone and the automobile, have eliminated the discomforts of farm life and have helped to make farming one of the best and most pleasurable professions.

Personal Instruction

A corps of capable instructors, each experienced in his special branch of rural engineering, takes a close personal interest in the progress of each student. The student will remember what he learns. He will be able to apply the knowledge he acquires to his every-day work.

Farm Engineering

(RE-8x)

The scientific farmer is the one who gets the most profit from the cultivation of his land. His crops are abundant. His house has all the comforts of the city home. His farm is generally free from all encumbrance. He has no problems that should worry him. This course goes into every phase of Farm Engineering and supplies the student with the training necessary to help him become an efficient, scientific farmer.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms and how to use them. Engineering problems in which logarithms must be used and also problems in which it is convenient to use them. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

FARM DRAFTING (RE-7)—Practice and use of instruments. Principles of orthographic drawing. Freehand sketching. Lettering. Working drawings of buildings and machinery. Designing of farm structures. Map and topographical drawing. Construction data.

FARM WATER SUPPLY (RE-2)—Advantages and convenience of pure water. Dangers of

* *Optional.* (*See Page* 12.)

impure water. Methods of purification. Supplies from underground waters, wells, springs, rivers, lakes and rain water cisterns. Various types of pumps and their operation. Installation of pumping systems. Use of pneumatic tanks. Hydraulic siphons. Piping the water supply. Disposal of drainage through cesspools. Septic tanks and other installations.

FARM DRAINAGE (RE-1)—Drainage as related to soils and the practical benefits. Kinds of drains. Location of drains. Arrangements, size and depth of drains. Levels and grades. Preparation of plans. Construction of drains and their appurtenances. Methods of excavation. Records of drainage projects. Cooperative drainage. Drainage of various kinds of soil. Drainage of irrigated lands. Control of hill waters.

FARM WATER POWERS (RE-3)—Development of small streams. Limitations of streams. Measuring their value by weirs, etc. Development of electricity. Operation of farm machinery. Equipment such as turbine wheels and rim leverage wheels. Dams. Conduits. Use of concrete and its manufacture. Installation of equipment.

AGRICULTURAL CHEMISTRY (Ag-2)—Elements. Formulas and equations. Bases. Elements necessary for plant growth. Formation, composition and fertility of soils. Fertilizers. Animal nutrition. Feeds and calculations of rations.

TRACTORS AND FARM MACHINERY (RE-4) Sources of power. Internal combustion engines. Steam engines and boilers. Steam and gas tractors. Stationary gasoline and kerosene engines.

FARM BUILDING CONSTRUCTION (RE-5)—Construction of frame buildings. Concrete in frame buildings. Design and construction of farm houses.

PLAIN CONCRETE CONSTRUCTION (CE-13)—Cements, limes and aggregates. Specifications and tests. Proportioning of materials. Construction of forms. Mixing and handling of concrete. Elementary principles of reinforced concrete and its strength. Concrete surface finishes. Stucco and plaster work. Water-proofing and coloring concrete. Precast concrete shapes. Sidewalks. Floors. Roads. Tanks. Cisterns. Silos. Small highway bridges and culverts.

Farm Water Supply

(RE-3x)

Bring the conveniences of the city to your farm and at the same time safeguard your famlly and stock against unhealthful water. Impure water can be made pure. The water supply can be brought into your kitchen and bathroom and even into your barns by mechanical means, thus eliminating the necessity of having to go out to the pump. How best to utilize your water resources and install all the necessary plumbing fixtures are taught in a practical manner. The course will be interesting to the farmer and to the country surveyor who wishes to engage in rural engineering.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

FARM WATER SUPPLY (RE-2)—Design, construction and maintenance of small water supplies.

Advantages of Pure Water Supply—Convenience of water indoors. Dangers of impure water. Methods of purification.

Sources of Water Supply—Underground waters. Wells and their protection. Springs, rivers, lakes and rain waters.

Pumps and Pumping—Action of air as applied to pumps. Methods of operation. Standard types of pumps. Methods of installation. Running water produced by pneumatic tanks. Use of hydraulic siphon.

Plumbing and Sewage Disposal—Installation of piping. Discussion of cesspools. Septic tanks Other methods of sewage disposal.

Farm Drainage

(RE-2x)

Each year millions of dollars are lost by farmers because they neglect to drain their land properly. The undrained areas are often, if not generally, the richest portions of a farm. In every state there are thousands of farms that could produce much larger crops if an efficient drainage system were installed. There are many opportunities in every farming region for the man with a technical knowledge of farm drainage as taught in this course. It will not only prove of value to the farmer, but to the student of agriculture.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

FARM DRAINAGE (RE-1)—Design, construction and maintenance of farm drainage systems.

General Considerations—Soil as related to drainage. Artificial drainage. Practical benefits. Kinds of drains. Drainage systems and their location.

Drain Construction—Spacing. Depth. Methods of determining the required sizes of drains. Determination of levels and grades. Best

means of preparing paper plans. Laying trench tile. Silt basins. Inlets and outlets. Use of excavating machinery.

Managing Drainage Projects—Compiling and preserving records of drainage work. Costs and financial considerations. Cooperation in prosecuting drainage projects.

Special Problems of Drainage—Drainage on farm premises. Road drainage. Muck lands. Salt marshes. Alkali lands in humid regions. River and creek bottoms. Irrigated lands. Special treatment to prevent side hill erosion.

Farm Water Powers

(RE-4x)

Every farmer who has a brook or large stream on his farm should learn how to make that stream work for him. Through a study of this course he will be able to turn this latent energy into a valuable working tool that will increase his production efficiency. This course will not only be of value to the farmer, but also to the country surveyor, as it sets forth the methods of developing water power for every use on the farm.

Subjects Covered in This Course:

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

FARM WATER POWERS (RE-3)—Investigation, construction and operation of small water powers.

Estimating the Opportunity—Small stream developments, their limitations, estimating their value. Measurement by weirs. Electricity from small water powers. Irrigation, drainage and water supply handled by water power. Operation of farm machinery.

Equipment Required—Turbine wheels. Rim leverage wheels. Dams for collecting water. Conduits for carrying water. Concrete construction. Installation of equipment.

Farm Drafting

(RE-7x)

A course for farmers or farmer's sons, giving them sufficient knowledge of drafting methods to enable them to design and make plans for buildings and other improvements. It is part of the complete course in farm engineering.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

FARM DRAFTING (RE-7)—Practice and use of instruments. Principles of orthographic drawing. Freehand sketching. Lettering. Working drawings of buildings and machinery. Farm structure of designing. Map and topographical drawing. Construction data.

NOTE.—Mathematics and drafting may be studied together.

Farm Building Construction

(RE-6x)

The course is prepared particularly for progressive farmers who desire to study modern designs of farm buildings and their construction. Farmers will find this course an aid in planning or remodeling their farm buildings.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ARITHMETIC (Ma-1)—Practical problems, helpful explanations, and calculations involving arithmetic only. Practical considerations emphasized throughout.

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

FARM DRAFTING (RE-7)—Plates on practice and use of instruments. Principles of orthographic drawing. Freehand sketching. Lettering. Working drawings of buildings and machinery. Designing of farm structures. Map and topographical drawing. Construction data.

FARM BUILDING CONSTRUCTION (RE-5)—Construction of frame buildings. Concrete in farm buildings. Design and construction of farm houses.

NOTE.—Mathematics and drafting may be studied together.

Farm Mechanics

(RE-1x)

Modern farming conditions have developed rapidly during the past few years. As a result the daily drudgery endured by the farmer of the past is now for the most part performed by mechanical energy that not only makes his work easier and more enjoyable, but results in better and more prolific crops. Satisfaction and also profitable returns are dependent upon a thorough knowledge of farm machinery. This course will meet the mechanical needs of the farmer from every angle. It not only demonstrates the construction, use and repairs necessary for all kinds of farm implements and other machinery, but also covers in detail their care and upkeep.

Topics Covered in This Course:

FARM MECHANICS (ME-19)—Farm carpentry tools. Rope. Hammer repairs. Plans. Soldering. Babbitting. Harrows. The cream separator. Seeding machinery. Harvesting machinery. Haying machinery. Threshing machinery. Manure spreaders. Corn machinery. Feed mills. Road machinery. Wagons. Pumps. Animal motors. Windmills. Steam boilers. Steam engines. Gas, oil and alcohol engines. Steam and gas tractors. Electrical machinery. The farm shop.

Detailed Descriptions with Drawings and Specifications for Making—Saw horse. Doubletree. Orchard solder. Hay rack. Wagon box. Top wagon box. Stock rack for wagon box. Self-feeder for hogs. Sheep feeding rack. Hog and sheep shipping crate. Stitching horse. Packing table for boxing apples. Packing table for barrelling apples. Water trough. Bag holder. Kitchen table.

Tractors and Farm Machinery

(RE-5x)

On the modern farm the use of power and machinery to do work formerly done by hand or animal power, is becoming more and more prevalent. The knowledge and ability to select the tractor or machine best adapted to the work, and to operate and maintain it, is of inestimable value to the farm operator or owner. This course gives the student the knowledge that will enable him to fulfill the above requirements.

Subjects Covered in This Course:

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

TRACTORS AND FARM MACHINERY (RE-4)—**Internal Combustion Engines**—Types. Horse power. Mechanical construction. Principles of operation. Adjustment of carburetors. Magnetos. Batteries. Ignition systems. Timing ignition. Methods of lubrication. Oils. Greases. Power. Speed. Operating cost of internal combustion engines. Farm engines. The gas tractor. Getting most power out of fuel. Tractor requirements. Overhauling a tractor.

Steam Power—Types of steam boilers, care and repair. Boiler accessories. Prevention and removal of scale. Types of steam engines, operation, care and repair. Operation, care and repair of steam tractors.

Farm Machinery—Windmills. Tillage, harvesting and threshing machinery. Pumping machinery.

Appreciates Interest Instructors Took in His Work

Now that I have completed the Farm Management Course, I wish to thank you very much for your help all through the course. The way you have corrected my papers, and the interest that you have taken in me and my work is so much more than I expected when I started. I think that I may be back with you again sometime.

The course I have just completed is, in my opinion, all that could be expected and is certainly a very great help to farmers and would-be farmers.—LOUIS O. OLESEN, Lake Wilson, Minn.

Tractors and Farm Machinery Course Exceeds Expectations

I am very grateful for the kind attention and remarks you have made and given on my work, and the course has (though not yet completed) far exceeded expectations.—FREDERICK J. KING, Calgary, Alberta, Canada.

Poultry Course as Good as Conferences with Experts

I have read considerably among the available poultry books and magazines, and the study of your course is by far the most profitable reading I have done . . . for it gives a thorough and honest discussion of all sides of each question, leaving it to the good judgment of the student as to which method would give the best results in his particular case. After studying each lesson, I feel as though I had met in conference all those who have successfully accomplished certain results with poultry, and had the frank advice and combined best judgment of all of them.—THEODORE N. BATES, Elyria, Ohio.



WITH the development of railway transportation and the modern locomotive, the duties of railway men throughout the country have become correspondingly more complex and exacting. This applies particularly to the locomotive engineer.

The locomotive of twenty years ago compares with the modern locomotive much as a tug boat compares with the giant battleship. It represents a huge power plant, doing as much work as twelve to fifteen ordinary stationary engines whose power is supplied by as many boilers. In the locomotive of today, there are two to four large traction engines for pulling cars—sometimes even an auxiliary engine called a "booster." There are a complete electric light and power plant; air compressors and pneumatic engines, including air-brake apparatus; engines for hauling coal from tender to fire-box; engines for shaking the grates; for opening the fire-door and for ringing the bell.

Many locomotives have a complete hydraulic or water plant—one that operates by steam—the object of which is to change the water into steam more quickly and without cooling steam already in the boiler. There is a steam superheating plant for conserving the heat produced by the fuel, and another steam plant for heating the trains.

The engineer must understand the principles of operation of all these various appliances, and many more, such as the feed water apparatus, the speed measuring devices, the instruments for determining the heat in the steam and the intricate parts of the air-brake.

The air-brake is absolutely essential in the operation of the modern locomotive. The engineer must understand the principles of operation of the many air-brake parts and the correct method of handling the system in controlling the speed and stopping the train. Upon the engineer's knowledge and skill in handling the air-brake depends the safety of the lives entrusted to his keeping.

A complete knowledge of the details of locomotive operation requires more than mere daily experience. The engineer should supplement his daily experience with systematic study. The best time to study is while serving his engineer apprenticeship as locomotive fireman, or while working as roundhouseman and preparing for the position of fireman. These Railway Courses are thoroughly up-to-date, and it is the intention of the United Y.M.C.A. Schools to keep them so. In addition to the regular instruction papers of the modern locomotive courses, twelve printed lectures on the most important subjects are furnished the student. As new devices are developed for use on the locomotive, special bulletins and lectures covering mechanical details and methods of operation will be issued.

Instruction

As one of the foremost instructors in railway work, F. L. Jones, the active head of the Railway Department, offers every railway student the invaluable benefit of his knowledge, which he has accumulated through years of experience and study. For several years he was associated with some of America's largest railroads in an advisory capacity. He spent twenty years as instructor of locomotive engineering and operation of railways in the United States and Canada. Many of his books on locomotive operation and air-brake practice are recognized authorities. He has been very successful in instructing locomotive firemen and engineers. Assisting Mr. Jones are capable instructors, each expert in his individual line.



F. L. JONES

Locomotive Engineering for Railway Shopmen

(RR-9x)

The locomotive man who wishes to advance in his chosen field must be able to visualize the locomotive in its entirety. He must understand all the fundamental principles that underlie its design, as well as its construction and maintenance.

Railway companies are constantly on the lookout for new improvements and more economical methods of operation. They depend upon the ingenuity of their engineers for these improvements, whether they are employed in the drafting room, the erecting shop, or the repair shop. Each engineer must be prepared to demonstrate his worth by a sound knowledge of the best modern methods.

This course is intended to train the shop foreman, machinist, locomotive apprentice, or shopman to advance to a position as engineer or superintendent of motive power, and to fit him for the responsibilities and tests he will be called upon to meet in these positions.

Subjects Covered in This Course:

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional charge.

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work of this course.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

MACHINE SKETCHING (Dr-48)—Training in the sketching of machine parts. Sketches of machine details. Sections and assemblies. Assembly sketches from machine details.

MECHANICS (CE-11)—Components of forces. Resultants. Equilibrium of forces. Laws of sines. Parallel forces. Center of gravity. Moment of inertia. Laws of friction. Kinetics. Uniform motion. Accelerated motion. Rotary motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

PHYSICS (Ac-26)—Simple and direct instruction dealing with transfer of energy and properties of matter. Heat and light. Electricity and magnetism.

MECHANICS OF MATERIALS (CE-12)—Strength of materials. Deformation. Elastic change of length. Properties of materials of engineering. Beams. Theory of beams. Reactions. Vertical shear. Bending moments. Internal and external forces. Safe loads. Column formulas. Combined stresses. Axial shear. Horizontal shear. Resilience and work. Impact. Fatigue of materials. Torsion of shafts.

LOCOMOTIVE BOILERS (RR-1)—Principles of construction of common types of boilers. Draft and draft appliances. Injector principles. Boiler attachments. The locomotive superheater. Principles of locomotive construction. Valve gears. Compound locomotives.

LOCOMOTIVE CONSTRUCTION (RR-2)—Principles of locomotive construction. Names and functions of principal parts. Stephenson link valve gear. Walschaert valve gear. Baker valve gear. Compound locomotives.

STEAM DISTRIBUTION (RR-3)—Types of locomotive main valves. Valve motion and steam distribution. Defects in valve motion. Locating defects in the valve gear. Locomotive valve setting.

LOCOMOTIVE RUNNING (RR-4)—Duties of the engineer. Economical steam consumption. Reporting defects and needed repairs. Train handling.

BREAK-DOWNS AND THEIR REMEDIES (RR-5)—Break-downs in the valve gear. Break-downs in the running gear. Broken spring rigging.

ELECTRIC HEADLIGHTS (RR-6)—Operation and care of the electric headlight.

WESTINGHOUSE AIR-BRAKE (RR-7)—Air compressors. The compressor governor. A-1 locomotive brake. Engine and Tender brake (E. T. No. 6). Foundation driver brake gear. Principles of the automatic air brake. Triple valves. The "K" freight triple valve. L-N passenger car brake. UC passenger car brake. Air signal equipment. Freight train braking. Passenger train braking. Terminal tests of brakes. Air brake inspection. Air brake defects and their remedy.

MACHINE SHOP TOOLS AND METHODS (ME-14)—Measuring instruments, micrometer calipers, limit gauges, hand tools and their use. Comprehensive treatment of engine lathe, and its various uses. Special lathes, turret lathes, gap lathe, screw cutting machines. Shapers. Slotters. Milling machines. Boring and drilling machines. Gear cutting machines. Key seating machines. Emery wheels. Grinding machines. Cutting tools. Speeds and feeds. Speeds and feeds for grinding.

ENGINE ROOM METHODS (ME-2)—Heat, work and pressure. Formation of steam. Superheated steam. The indicator. Ratio of expansion. Mean effective pressure. Principles of the Steam Engine. Automatic high-speed engines. Corliss, cross-compound, tandem-compound, Locomobile, and uniflow engines. Action of steam in cylinder. Steam

engine testing. Slide valves. Poppet valves. Valve setting. Operation and maintenance. Condensers. Cooling ponds and towers.

Gears—Meyer valve gear. Stephenson link motion. Walschaert valve gear. Corliss valve gear.

Governors—Pendulum governors. Shaft governors. Inertia governors. Centrifugal governors.

Lubrication—Friction. Characteristics of oil. Testing oils. Lubricating systems.

Turbines—General principles. Types of turbines. Operation and maintenance.

PRINCIPLES OF LOCOMOTIVE DESIGN (RR-9)—General considerations. Classification of locomotives. Purpose and effects of various types of locomotives. Necessity of standards. Selection and design of the boiler. Factors of safety. Tests of materials. Factors of economy. Selection of economical devices. Master Mechanics Standards.

LOCOMOTIVE MAINTENANCE (RR-10)—Locating pounds and blows. Locomotive lubrication. General locomotive inspection. Interstate Commerce Commission requirements on locomotive inspection. Locomotive shop kinks.

Modern Locomotive Operation

(RR-1x)

This course is a complete treatise on the operation of the modern locomotive from the viewpoint of the locomotive engineer and fireman. It is intended only for those actually employed as locomotive engineers or firemen, or those who have had some experience as such. It may also be studied by roundhousemen or shopmen who would be eligible for promotion to locomotive firemen. It is recommended to firemen who wish to prepare for any of the progressive examinations or final examination for promotion to engineer.

Subjects Covered in This Course:

LOCOMOTIVE BOILERS (RR-1)—Principles of construction of common types of boilers. Draft and draft appliances. Methods of firing. Injector principles and boiler feeding. Boiler attachments. The locomotive superheater.

LOCOMOTIVE CONSTRUCTION (RR-2)—Principles of locomotive construction. Names and functions of principal parts. Stephenson link valve gear. Walschaert valve gear. Baker valve gear. Compound locomotives.

STEAM DISTRIBUTION (RR-3)—Types of main valves. Valve motion and steam distribution. Defects in valve motion. Locating trouble in valve gear.

LOCOMOTIVE RUNNING (RR-4)—Locomotive inspection. Engine management. Locating pounds in the engine. Locating blows in the main valves and steam connections. Locomotive lubrication.

BREAK-DOWNS AND THEIR REMEDIES (RR-5)—Break-downs in the valve gear. Break-downs in the running gear. Broken spring rigging.

ELECTRIC HEADLIGHTS (RR-6)—Operation and care of the electric headlight.

WESTINGHOUSE AIR-BRAKE (RR-7)—Air compressors. The compressor governor. Engine and tender brake (E. T. No. 6). A-1 locomotive brake. Foundation driver brake gear. Principles of the automatic air-brake. Triple valves. The "K" freight triple valve. L-N passenger car brake. Universal (U-C) passenger car brake. Air signal equipment. Freight train braking. Passenger train braking. Terminal tests of brakes. Air-brake inspection. Air-brake defects and their remedies.

TRAIN RULES (RR-8)—The function of the American Railway Association. The standard code of train rules. General rules defining the duties of employees. Definition of terms. Authority for movement of trains. Train signals. Classification of trains. Train orders.

With this course the student is provided with a set of 62 large specially engraved charts that illustrate the construction and operation of the air-brake.

Complete Locomotive Operation for Shopmen

(RR-12x)

This course is intended for shopmen and roundhousemen who may wish to study locomotive operation and maintenance from the viewpoint of the expert mechanic and shop foreman. The instruction in locomotive running and management, air-brake operation and train handling, are intended to give the shopman complete information about the duties of the fireman and engineer, and the many incidentals of practical operation of the engine while on the road, in order that the shopman and engineer may obtain the best results in the upkeep of the locomotive.

Subjects Covered in This Course:

PRACTICAL MATHEMATICS FOR RAILWAY SHOPMEN (Ma-28)—Simple processes of whole numbers and fractions. Decimals and percentage as applied to shop problems. Calculations of the commonly used geometrical figures and solids. How to use tables and curves. Use of simple formulas. Problems in mathematical principles used in daily shop practice.

PRACTICAL MECHANICS FOR RAILWAY SHOPMEN (RR-11)—Calculation of forces. The simple machines. Screw threads. Simple and compound gearing. Calculation of speeds and feeds. Problems on work and power. Heat. Strength of materials. Problems in mechanical principles used in daily shop practice.

LOCOMOTIVE BOILERS (RR-1)—Principles of construction of common types of boilers. Draft and draft appliances. Methods of firing. Injector principles and boiler feeding. Boiler attachments. The locomotive superheater.

LOCOMOTIVE CONSTRUCTION (RR-2)—Principles of locomotive construction. Names and functions of principal parts. Stephenson link valve gear. Walschaert valve gear. Baker valve gear. Compound locomotives.

STEAM DISTRIBUTION (RR-3)—Types of main valves. Valve motion and steam distribution. Defects in valve motion. Locating trouble in valve gear.

LOCOMOTIVE RUNNING (RR-4)—Engine management. Locating pounds in the engine. Locating blows in the main valves and steam connections. Locomotive lubrication.

BREAK-DOWNS AND THEIR REMEDIES (RR-5)—Break-downs in the valve gear. Break-downs in the running gear. Broken spring rigging.

ELECTRIC HEADLIGHTS (RR-6)—Operation and care of the electric headlight.

WESTINGHOUSE AIR-BRAKE (RR-7)—Air compressors. The compressor governor. Engine and tender brake (E. T. No. 6). A-1 locomotive brake. Foundation driver brake gear. Principles of the automatic air-brake. Triple valves. The "K" freight triple valve. L-N passenger car brake. Universal (U-C) passenger car brake. Air signal equipment. Freight train braking. Passenger train braking. Terminal tests of brakes. Air-brake inspection. Air brake defects and their remedies.

PRINCIPLES OF LOCOMOTIVE DESIGN (RR-9)—General considerations. Classification of locomotives. Purpose and effects of various types of locomotives. Necessity of standards. Selection and design of the locomotive boiler. Factors of safety. Tests of materials. Factors of economy. Selection of economical devices. Master Mechanics Standards.

LOCOMOTIVE MAINTENANCE (RR-10)—General locomotive inspection. Interstate Commerce Commission requirements on locomotive inspection. Safety appliance laws. Master Mechanics Standards. Locomotive shop kinks. Machine tool operation.

With this course the student is provided with a set of 62 large specially engraved charts that illustrate the construction and operation of the air-brake.

Locomotive Operation for Shopmen

(RR-10x)

There are many young men now employed in locomotive shops or roundhouses who are undecided as to the branch of work in which they would prefer to advance. They may either enter the road service as locomotive firemen and later become engineers, or they may decide to remain in the shops and seek promotion along mechanical lines. For such men this course will prove exceptionally helpful because it treats of the modern locomotive, both from the point of view of the locomotive fireman and engineer, and also from the standpoint of the shopman. The knowledge gained from the course will thus be of practical value in either branch of the service.

Subjects Covered in This Course:

LOCOMOTIVE BOILERS (RR-1)—Principles of construction of common types of boilers. Draft and draft appliances. Methods of firing. Injector principles and boiler feeding. Boiler attachments. The locomotive superheater.

LOCOMOTIVE CONSTRUCTION (RR-2)—Principles of locomotive construction. Names and functions of principal parts. Stephenson link valve gear. Walschaert valve gear. Baker valve gear. Compound locomotives.

STEAM DISTRIBUTION (RR-3)—Types of main valves. Valve motion and steam distribution. Defects in valve motion. Locating trouble in valve gear.

LOCOMOTIVE RUNNING (RR-15)—Locomotive inspection. Locating blows in main valves and steam connections. Locating pounds in the driving gear. Testing for leaks in the front end.

ELECTRIC HEADLIGHTS (RR-6)—Operation and care of the electric headlight.

WESTINGHOUSE AIR-BRAKE (RR-7)—Air compressors. The compressor governor. Engine and tender brake (E. T. No. 6). A-1 locomotive brake. Foundation driver brake gear. Principles of the automatic air-brake. Triple valves. The "K" freight triple valve. L-N passenger car brake. Universal (U-C) passenger car brake. Air signal equipment. Terminal tests of brakes. Air-brake inspection. Air-brake defects and their remedies.

With this course the student is provided with a set of 62 large specially engraved charts that illustrate the construction and operation of the air-brake.

Advanced Locomotive Operation for Shopmen

(RR-11x)

This course is for shopmen and roundhousemen who wish to study modern locomotive operation and maintenance from the viewpoint of the expert mechanic and shop foreman, without the consideration of the many details that are involved in the work of the engineer and inspector.

Subjects Covered in This Course:

PRACTICAL MATHEMATICS FOR RAILWAY SHOPMEN (Ma-28)—Simple processes of whole numbers and fractions. Decimals and percentage as applied to shop problems. Calculations of the commonly used geometrical figures and solids. How to use tables and curves. Use of simple formulas. Problems in mathematical principles used in daily shop practice.

PRACTICAL MECHANICS FOR RAILWAY SHOPMEN (RR-11)—Calculation of forces. The simple machines. Screw threads. Simple and compound gearing. Calculation of speeds and feeds. Problems on work and power. Heat. Strength of materials. Problems in mechanical principles used in daily shop practice.

LOCOMOTIVE BOILERS (RR-1)—Principles of construction of common types of boilers. Draft and draft appliances. Methods of firing. Injector principles and boiler feeding. Boiler attachments. The locomotive superheater.

LOCOMOTIVE CONSTRUCTION (RR-2)—Principles of locomotive construction. Names and functions of principal parts. Stephenson link valve gear. Walschaert valve gear. Baker valve gear. Compound locomotives.

STEAM DISTRIBUTION (RR-3)—Types of main valves. Valve motion and steam distribution. Defects in valve motion. Locating trouble in valve gear.

LOCOMOTIVE RUNNING (RR-4)—Locomotive inspection. Engine management. Locating pounds in the engine. Locating blows in the main valves and steam connections. Locomotive lubrication.

BREAK-DOWNS AND THEIR REMEDIES (RR-5)—Break-downs in the valve gear. Break-downs in the running gear. Broken spring rigging.

ELECTRIC HEADLIGHTS (RR-6)—Operation and care of the electric headlight.

PRINCIPLES OF LOCOMOTIVE DESIGN (RR-9)—General considerations. Classification of locomotives. Purpose and effects of various types of locomotives. Necessity of standards. Selection and design of the locomotive boiler. Factors of safety. Tests of materials. Factors of economy. Selection of economical devices. Master Mechanics Standards.

LOCOMOTIVE MAINTENANCE (RR-10)—General locomotive inspection. Interstate Commerce Commission requirements on locomotive inspection. Safety appliance laws. Master Mechanics Standards. Locomotive shop kinks. Machine tool operation.

Locomotive Operation for Engineers

(RR-2x)

Locomotive engineers, traveling engineers and road foremen of engines who wish to study the locomotive in detail from their own viewpoint will find this course helpful, because it combines practical information with a thorough explanation of fundamental principles. It also treats of the most modern equipment and methods of operation.

Subjects Covered in This Course:

LOCOMOTIVE BOILERS (RR-14)—Injector principles and boiler feeding. Boiler attachments. The locomotive superheater.

LOCOMOTIVE CONSTRUCTION (RR-2)—Principles of locomotive construction. Names and functions of principal parts. Stephenson link valve gear. Walschaert valve gear. Baker valve gear. Compound locomotives.

STEAM DISTRIBUTION (RR-3)—Types of main valves. Valve motion and steam distribution. Defects in valve motion. Locating trouble in valve gear.

LOCOMOTIVE RUNNING (RR-4)—Locomotive inspection. Engine management. Locating pounds in the engine. Locating blows in the main valves and steam connections. Locomotive lubrication.

BREAK-DOWNS AND THEIR REMEDIES (RR-5)—Break-downs in the valve gear. Break-downs in the running gear. Broken spring rigging.

ELECTRIC HEADLIGHTS (RR-6)—Operation and care of the electric headlight.

WESTINGHOUSE AIR-BRAKE (RR-7)—Air compressors. The compressor governor. Engine and tender brake (E. T. No. 6). A-1 locomotive brake. Foundation driver brake gear. Principles of the automatic air brake. Triple valves. The "K" freight triple valve. L-N passenger car brake. Universal (U-C) passenger car brake. Air signal equipment. Freight train braking. Passenger train braking. Terminal tests of brakes. Air-brake inspection. Air-brake defects and their remedies.

TRAIN RULES (RR-8)—The function of the American Railway Association. The standard code of train rules. General rules defining the duties of employees. Definition of terms. Authority for movement of trains. Train signals. Classification of trains. Train orders.

With this course the student is provided with a set of 62 large specially engraved charts that illustrate the construction and operation of the air-brake.

Modern Air-Brake

(RR-5x)

The introduction of many new air-brake devices and improved methods of operation make it necessary for enginemen and shopmen to keep up-to-date on this most important locomotive apparatus. This course is especially prepared for locomotive engineers, firemen, shopmen and other railway employees.

Topics Covered in This Course:

WESTINGHOUSE AIR-BRAKE (RR-7)—Air compressors. The compressor governor. Engine and tender brake (E. T. No. 6). A-1 locomotive brake. Foundation driver brake gear. Principles of the automatic air-brake. Triple valves. The "K" freight triple valve. L-N passenger car brake. Universal (U-C) passenger car brake. Air signal equipment. Freight train braking. Passenger train braking. Terminal tests of brakes. Air-brake inspection. Air-brake defects and their remedies.

With this course the student is provided with a set of 62 large specially engraved charts that illustrate the construction and operation of the air-brake.

NOTE: Students employed on railways where New York air-brake equipment is used, will receive instruction papers on the New York air-brake in addition to those furnished on the Westinghouse air-brake.

Air-Brake for Locomotive and Air-Brake Inspectors

(RR-3x)

The air-brake inspector must be conversant with the latest, improved air-brake shop practice and methods of inspection. He must also understand safety appliance laws and the rules that enter so largely into general instructions issued to locomotive and air-brake inspectors. This course is intended especially for locomotive and air-brake inspectors who wish the most up-to-date instruction on air-brake practice.

Topics Covered in This Course:

WESTINGHOUSE AIR-BRAKE (RR-12)—Air compressors. The compressor governor. Engine and tender brake (E. T. No. 6). A-1 locomotive brake. Foundation driver brake gear. Principles of the automatic air-brake. Triple valves. The "K" freight triple valve. L-N passenger car brake. Universal (U-C) passenger car brake. Air signal equipment. Freight train braking. Passenger train braking. Terminal tests of brakes. Air-brake inspection. Air-brake defects and their remedies. Maintenance of locomotive brake equipment. Air-brake inspection for shopmen. Standard air-brake tests.

With this course the student is provided with a set of 62 large specially engraved charts that illustrate the construction and operation of the air-brake.

Air-Brake for Trainmen and Car Inspectors

(RR-4x)

During the last few years so much new air-brake equipment has been introduced and so many new improvements have been added that many trainmen now find themselves handicapped through an incomplete knowledge of modern air-brake equipment and rules of inspection. This course will enable these men to keep up-to-date by means of a systematic study of the modern air-brake. The course is especially helpful and practical because it has been planned from the trainman's and inspector's viewpoint and with their particular problems in mind.

Subjects Covered in This Course:

WESTINGHOUSE AIR-BRAKE (RR-13)—Foundation brake gear. Principles of the automatic air-brake. Triple valves. The "K" freight triple valve. L-N passenger car brake. Universal (U-C) passenger car brake. Air signal equipment. Terminal tests for brakes. Air-brake inspection. Air-brake defects and their remedies.

TRAIN RULES (RR-8)—The function of the American Railway Association. The standard code of train rules. General rules defining the duties of employees. Definition of terms. Authority for movement of trains. Train signals. Classification of trains. Train orders.

With this course the student is provided with a set of 62 large specially engraved charts that illustrate the construction and operation of the air-brake.

NOTE: Students employed on railways where New York air-brake equipment is used, will receive instruction papers on the New York air-brake in addition to those furnished on the Westinghouse air-brake.

Spare-hour education is offered by the United Y.M.C.A. Schools on the platform of: (1) the most service for the least money; (2) careful guidance in the choice of a course for every applicant; (3) the personal interest of a competent and sympathetic teacher; (4) as much encouragement to complete a course as to begin one.





H. P. FAWCETT

THE ability to measure accurately, to analyze correctly, and to compare intelligently, forms the very foundation of success. There is, perhaps, no other science which tends to develop these qualities so much as mathematics. The value of mathematics is recognized by every one engaged in any of the trades or in the engineering professions. Those who expect to gain success in these lines understand that mathematics is a necessary part of their training. It is just as true, however, that those who would succeed in commerce, business, politics, or in any other walk of life, will find a thorough training in mathematics almost indispensable in developing their ability to think clearly, to understand conditions thoroughly, and to act wisely.

For the convenience of the student, all mathematics courses have been arranged in two general groups—Applied Mathematics and Pure Mathematics, according to the uses to which they are to be put.

In the group entitled Applied Mathematics are to be found subjects in which the necessary principles of mathematics are set forth in the briefest possible way, and their direct practical application to the various trades and professions under consideration is developed.

In the group entitled Pure Mathematics are to be found courses, some of which at least, should be mastered by every man and woman with a serious view of life who wishes to assume a creditable place among friends, acquaintances, and business associates. These courses are the foundation for the study of many advanced scientific and commercial subjects. The study of every branch of mathematics is of value to the student in training his mind to grasp facts quickly and to reason in logical sequence.

Earnest Instructors

H. P. Fawcett, head of the Department of Mathematics, is particularly well fitted for the position. His experience and personal desire for each student's success enhances the value of the course. After specializing in mathematics at Mount Allison University and the University of California, he was instructor of mathematics at Fort Fairfield High School and later principal of the Day School in the San Francisco Y.M.C.A. Assisting Mr. Fawcett is a corps of experienced instructors, each expert in his special line.

APPLIED MATHEMATICS

Engineering Mathematics

(Ma-11x)

The purpose of this course is to provide a complete training in engineering mathematics from the beginning work of arithmetic up through that of plane trigonometry The student completing this course should be equipped to advance to higher mathematics and at the same time be well prepared to meet the requirements most frequently occurring in engineering practice. This course, taken as a whole, constitutes a thorough, fundamental training in mathematics up to analytic geometry.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Preliminary work. Common fractions. Decimal fractions. Weights and measures. Percentage and applications. Ratio and proportion. Density and specific gravity. Powers and roots.

GEOMETRY (Ma-2)—Plane surfaces, lines, and angles. Triangles. Circles. Graphic methods. Prisms. Cylinders. Pyramids. The sphere. Other solids. Formulas and tables.

ALGEBRA (Ma-3)—Notation and definitions. Formulas and translations. Positive and negative numbers. Addition and subtraction. Equations. Multiplication and division. Fractions. Equations and formulas. Exponents. Quadratic equations. Variation. Graphics.

TRIGONOMETRY (Ma-4)—Logarithms. Trigonometric functions. Tables and their uses. Right triangles. Relation between ratios and plotting. Trigonometric functions of more than one angle. Solution of oblique triangles.

Arithmetic for the Engineer

(Ma-4x)

Mathematics is a tool as necessary for the engineer as his mechanical tools or the construction material required in his engineering work. The student not already thoroughly grounded in the fundamentals of arithmetic should begin his study with this course in order that he may have a thorough knowledge of mathematical rules from the ground up. With the knowledge gained from studying this course he will begin to build a strong foundation for the subjects to follow and for his later engineering work.

Topics Covered in This Course:

ARITHMETIC (Ma-1)—Review of the four fundamental operations. Common fractions and their use with the emphasis on practical results. Percentage and its applications. Weights and measures, both the English and Metric systems being discussed. Tables of equivalents and their use. Ratio and proportion. Density and Specific Gravity. Powers and roots. The problems are especially valuable as a preparation for engineering work. They cover such subjects as the pitch and lead of screw threads. The use of the micrometer. Spiral gearing. Steam boiler proportions. The lever and hydraulic machines.

Geometry for the Engineer

(Ma-1x)

Some students may already have received a good training in arithmetic and may wish to begin their engineering mathematics with geometry. This subject provides a review of the work in arithmetic, and at the same time gives a thorough training in the rules and principles which form the second step in the foundation for engineering, design, construction and supervision.

Topics Covered in This Course:

GEOMETRY (Ma-2)—Areas of plane surfaces. Properties of triangles and circles. Graphical methods with special emphasis on problems of construction. Volume and area of cylinders, prisms, cones and spheres. Many practical problems are considered covering brick work, lumber, the steel square, screw threads, circular mills, belt pulleys, and gear wheels.

Algebra for the Engineer

(Ma-2x)

With a good working knowledge of arithmetic and geometry, the student should next proceed to the study of algebra, in order to understand the rules regarding formulas and their application to numerous engineering problems which arise in daily practice. Algebra affords means for solving problems which cannot be worked out by arithmetic or geometry alone. At the same time algebra is necessary for teaching shortened methods, and processes for saving time and labor. This course is also necessary for students who wish to advance to higher mathematical work.

Topics Covered in This Course:

ALGEBRA (Ma-3)—The language of algebra with definitions. The evaluation and transformation of formulas. Algebraic addition, subtraction, multiplication and division. The solution of simple, simultaneous and quadratic equations with interesting applications. Direct and inverse proportion. This course also includes special lessons on graphs showing their usefulness in all types of engineering work. The problems will be especially interesting covering such topics as horse power, relation of resistance, electromotive force and current, resistance of conductors and the strength of wooden beams. All of the formulas considered are those most commonly used by the engineer.

Trigonometry for the Engineer

(Ma-5x)

The engineer must secure the greatest possible production with the least outlay of time and material consistent with safety and cost of production. To accomplish this result he must be rapid and accurate in laying out work, in designing, estimating and in construction, as well as in supervising operation after construction. In short, the engineer must know what to do, when to do, and how to do. Mathematics, of which this subject is an important branch, assists the engineer as a guide in his judgment. Throughout this course constant reference is made to the rules of the more elementary branches of mathematics already studied, not only the pure mathematical rules but also their application to numerous practical problems in engineering practice. This course, although required in all branches of engineering, has a most extensive use in civil, mechanical and electrical engineering. This course is preparatory for those students who wish to advance to work in analytic geometry and calculus.

Topics Covered in This Course:

TRIGONOMETRY (Ma-4)—Logarithms with numerous applications. The six trigonometric functions defined and applied. Solution of right and oblique triangles. Functions of more than one angle. Graphical representation of functions. Many applications are given covering such topics as railroad curves, inclined plane, illumination, orthogonal projection, vectors, length of belts, screw threads, spirals, resultant of forces, and many others which will be especially helpful as a preparation for engineering work.

Calculus for the Engineer

Differential and Integral

(Ma-30x)

The purpose of this course is to provide the essential parts of both the differential and integral calculus with their particular applications to engineering problems. The course shows the use of the calculus for problems which are solved only with considerable difficulty by the more elementary branches of mathematics, and also gives processes for shortening solutions. A knowledge of science in engineering is not necessary to pursue this course, although the student should have covered mathematics through analytic geometry. This course is invaluable, not only for its direct bearing on engineering problems, but also as preparation for more advanced study.

Topics Covered in This Course:

CALCULUS FOR THE ENGINEER (Ma-8)—Elementary definitions. The derivative with differentiation of elementary form—algebraic, trigonometric, exponential and logarithmic. Maxima and minima with applications to engineering problems. Rates and differentials with geometrical and physical applications. Curve tracing and determination of asymptotes. Expansion of functions into series. Circle and center of curvature with engineering applications. Evolutes and involutes. Singular points and envelopes. Integration of the elementary forms. Integration as a summation with geometrical applications. Applications of integral calculus to problems of mechanics. The statement of actual problems of the sciences and engineering in the language of the calculus.

Shop Arithmetic

(Ma-29x)

This course teaches the fundamental principles of mathematics required for shopmen, by using familiar terms and processes, and problems which relate mainly to the metal working trades. The aim in preparing the material of this course has been to so apply it to these particular trades that it will be of considerable value to men in other lines of the metal industry. The purpose of this course is twofold—first, to give a thorough training in the problems of the shop, and second, to give further practice in essential calculations. It develops ability to handle simple formulas and gives the student a good knowledge of the principles of the simple machines. This course is required as preparation for the course in Advanced Shop Mathematics.

"The world is demanding as never before, men of good character with well-developed minds. Train your mind and get into the executive class where ability, energy and initiative are justly compensated."

Topics Covered in This Course:

SHOP ARITHMETIC (Ma-5)—Covering common and decimal fractions, wage calculations, percentage, ratio and proportion, powers and roots. The mechanical advantage and efficiency of machines is considered and applied to the lever, the tackle blocks, the inclined plane and the jack screw. Special consideration is given to pulley and gear trains, cutting and grinding speeds, thread cutting, areas and volumes of simple figures, belting, horse power of machines, mechanics of fluids, heat, and strength of materials.

Advanced Shop Mathematics

(Ma-28x)

The skilled mechanic whether patternmaker, machinist or electrician, must know how and when to use many rules of his trade. Especially must the high-grade man understand the principles of formulas, in order to select them properly, apply them intelligently, and work them through correctly. This course develops the student's ability to understand and apply mechanical principles required in shop problems, and gives him a good mathematical background for more advanced technical study.

Topics Covered in This Course:

ADVANCED SHOP MATHEMATICS (Ma-6)—Algebraic terms defined and explained. The usefulness of formulas with methods of transformation. The four fundamental operations applied to algebraic expressions. Solution of simple, simultaneous and quadratic equations with interesting applications. Graphical representation of shop work with emphasis on the use and value of curves. Geometric constructions showing the properties of geometric figures, areas and volumes of geometric figures with applications to problems especially adapted to the man in the shop. Practical applications of the six trigonometric functions, solution of right and oblique triangles. The problems are of the most interesting nature covering such topics as tapers and taper turning, screw threads and spirals. Logarithms and their use.

Mathematics for Machinists and Toolmakers

(Ma-27x)

In addition to handling his tools and material, a machinist must above all be able to make measurements accurately and to calculate correctly from his measurements. Figures are tools which assist in securing accuracy and in saving time and material. The well-trained mechanic does not have to depend on others to tell him what size gauge to use, what gears are required or how to calculate the depth of an 8-pitch thread. This course gives a thorough training in the mathematics of the machine shop and prepares for better daily work and advancement.

Subjects Covered in This Course:

SHOP ARITHMETIC (Ma-5)—Common fractions. Addition and subtraction of fractions. Money and wages. Decimal fractions. Percentage. Circumferences of circles. Ratio and proportion. Pulley and gear trains. Areas and volumes of simple figures. Square root. Mathematical tables. Levers. Tackle blocks. Inclined plane and screw. Work, power, and energy. Horse power of engines. Mechanics of fluids. Heat. Strength of materials.

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas. Explanation of terms. Algebraic addition. Algebraic subtraction. Transformation of formulas. Algebraic multiplication and division. Solution of simple equations. Simultaneous equations. Quadratic equations. Tables and curves. Equations of curves. Geometric constructions. Construction and properties of geometric figures. Area of geometric figures. Volumes and surfaces of solids. The tangent. Cotangent. Some uses of tangent and cotangent. The sine, cosine, secant, and cosecant. Screw threads. Spirals. Solution of triangles. Logarithms. Logarithms of decimals, powers, and roots.

Cannot Speak Too Highly of Course and Instructors

My course in Arithmetic for the Engineer has been almost my whole recreation since I started it. My instructors have been both willing and capable. I have called on them very little, but when I have asked for information I have received the best of capable and prompt attention. and cannot speak too highly of my course or my instructors. I find the course, as a whole, plain, concise and helpful, and have already noticed its help in my daily work.—LYLE C. TAYLOR, Clarkston, Wash.

Arithmetic for Carpenters and Builders

(Ma-31x)

The carpenter and builder who wishes to advance in his calling will be materially aided by a thorough knowledge of the fundamental rules of measurement, planning and estimating, and construction. The course shows the application of arithmetic to building construction, and also considers methods of saving time and labor. For example, the steel square, whose possibilities are not fully realized by the average worker, is considered at length.

Topics Covered in This Course:

ARITHMETIC FOR CARPENTERS AND BUILDERS (Ma-22)—The addition and subtraction of units of length. Common and decimal fractions. Statements, accounts and building estimates. Percentage and its application. Ratio and proportion. Linear measure. Areas and volume. Powers and roots. Lumber terms and dimensions. The problems considered have to do with the lever, weight of building materials, bearing power of soils, concrete mixtures, capacity of tanks and cisterns, and estimation of the amount of lumber needed in various constructions. The final section of the course covers Builders' Geometry and includes certain geometric constructions, areas of surfaces with detailed treatment of the use of the carpenter's square.

Business Arithmetic

(Co-2x)

The person who is already engaged in, or expects to enter business should have a thorough knowledge of the use of arithmetic in important business operations. He should have skill, speed and accuracy in working out his transactions, and also be able to prove his work. This course is a practical and very helpful one, for it gives the student the fundamental equipment which every successful business man must possess. In addition it increases the student's knowledge of the more common usages, and the language of commerce.

Topics Covered in This Course:

BUSINESS ARITHMETIC (Co-11) — **Fundamentals**—United States money. Simple problems in accounting. Fractions. Decimals. Various practical problems involving measurement. Percentage and its applications to business.

Partnerships—Arithmetical calculations and simple problems in bookkeeping involved in joint ownership.

Banking—Interest. Bank discount. Partial payments. Bankers' daily balances. Savings bank accounts. Exchange.

Business—Bills and accounts. Cash balance. Equation of accounts. Dividends and investments. Brokerage. Insurance. Taxes. Customs duties. Trade acceptance.

Use of Slide Rule

(CE-3x)

As a time and labor saving device the slide rule is invaluable. Its use applies equally well to general business or technical work. The slide rule in its ordinary sizes applies for computations requiring an accuracy not greater than that given by three significant figures and this course is highly recommended for those whose work requires an accuracy of this order. The cost of this course and rule is practically insignificant in comparison to the great saving in time and labor which may be effected through its use. The rule is adapted not only for all the simple arithmetical operations, except addition and subtraction, but also for use in trigonometric computations and many special purposes.

Subjects Covered in This Course:

ARITHMETIC (Ma-1) — Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations that occur later in the course. Graphs and how to make them.

THE USE OF SLIDE RULE (CE-1)—General discussion of its theory and uses.

Logarithms — Exponential theory. Application in multiplication, division, and in finding powers and roots.

The Rule—Its construction and care. Various types of slide rules.

Use of the Rule—Multiplication and division. Squares and square root. Cubes and cube root. Trigonometric solutions with the sine and tangent scales. Determination of other angular functions. Use of inverted and reversed scales. Solutions for fractional powers. Mixed operations. Locating the decimal point.

PURE MATHEMATICS

Arithmetic for Beginners

(Ma-33x)

Those who wish to know the fundamental processes of arithmetic as usually taught in the first six grades of the public schools should study this course. While elementary in character it is written in such a way that any man or woman who needs a review of arithmetic will find a thorough presentation of the subject in this course.

Topics Covered in This Course:

ARITHMETIC FOR BEGINNERS (Ma-26)—Counting. Addition. Subtraction. Multiplication. Division. Fractions. Decimals. Denominate numbers. Percentage. Profit and loss. Commission. Commercial discount. Interest.

Elementary Algebra

(Ma-17x)

A thorough course covering Algebra up to quadratics. Among the interesting features of this course are many discussions and illustrative problems drawn from commercial life, from physics, from geometry, and from various topics of modern interest. A good deal of stress is laid on the construction and interpretation of graphs as well as the graphical solution of equations. This makes the course doubly valuable because of the many uses and practical applications of graphs that aid the business or professional man today.

Topics Covered in This Course:

ELEMENTARY ALGEBRA (Ma-11)—The language of algebra with definitions. Algebraic addition, subtraction, multiplication and division. Positive and negative numbers. Solution of simple and simultaneous equations. Graphical solution of equations. Factoring. Involution and evolution. Theory of exponents, radicals and imaginary numbers.

Intermediate Algebra

(Ma-18x)

This course covers Intermediate Algebra as required by the Board of Regents in the New York State standard examinations and is a good preparation for Advanced Algebra as well as for those mathematical subjects generally considered in a regular high school curriculum.

Topics Covered in This Course:

INTERMEDIATE ALGEBRA (Ma-12)—Quadratic equations, complete and incomplete. Quadratic equations solved with emphasis on graphical solutions. The general properties of quadratics discussed as to the nature and number of the roots and the relation of roots and coefficients. Inequalities. Ratio and proportion. Interpretation of results. Binomial theorem. Logarithms and complex numbers. Many interesting supplementary exercises are given.

Advanced Algebra

(Ma-19x)

This course is the equivalent of any regular college course and in preparing it every effort has been made to give the best possible training in algebraic analysis. Both Elementary and Intermediate Algebra are reviewed before proceeding to the more advanced principles. The discussion of each new principle is clearly presented and the whole subject is treated in an interesting and readable manner.

Topics Covered in This Course:

ADVANCED ALGEBRA (Ma-13)—Elementary and Intermediate Algebra reviewed. General properties of quadratic equations discussed in detail. Surds and imaginaries. Indeterminate equations. Ratio, proportion and variation. Progressions. Binomial theorem. Logarithms. Interest and annuities. Variables and limits. Convergency of series. Factorial binomial theorem. Indeterminate coefficients. Determinants. The general properties of equations. Synthetic division. Graphical representation of functions. Derivatives. Transformation of equations. Descartes' rule of signs. Commensurable and incommensurable roots. Location of roots. Horner's method of approximation. Sturm's theorem. General solution of equations. Complex numbers.

Grammar School Arithmetic

(Ma-34x)

The commonest transaction requires the use of at least some simple calculation. Skill in numerical computations and the ability to reason rapidly and accurately are necessary in all walks of life. Nothing is so helpful in acquiring this skill as a good course in Arithmetic. This course starts with the fundamental ideas on which arithmetic is based and covers the subject as required in the grammar and high school standards. It also affords a good training along business lines and serves as a preparation for the more advanced mathematics.

Topics Covered in This Course:

GRAMMAR SCHOOL ARITHMETIC (Ma-27)—Systems of notation and numeration. Addition, subtraction, multiplication and division. Factoring and cancellation. Common and decimal fractions. Tables of weights and measures with applications. Practical measurements applied to estimating the cost of plastering, painting, carpeting, papering and paving. Percentage with problems on profit and loss, commission, discount, taxes and insurance. Simple and compound interest. Domestic and foreign exchange. Partnership. Ratio and proportion. Powers and roots. Average of payments and accounts. Annuities. Arithmetical and geometrical progression.

Plane Geometry

(Ma-20x)

This course is a thorough treatment of the elements of Plane Geometry as covered in any high school course and is preparatory to the work in Solid Geometry. The student is introduced to the practical use of instruments and the value of studying geometry is shown in an interesting way. The exercises, which in some respects constitute the most important part of the course, have been chosen with a great deal of care, and there is a marked absence of the difficult puzzle found in most high school courses. One student writes: "I have studied part of this subject at high school, but I have found your course is more complete, and goes into such detail that it is hardly possible for me to say 'I can't understand it.' Each lesson is a stepping stone for the next and it is surely an easy way to learn this subject. Perhaps it is the easiest way."

Topics Covered in This Course:

PLANE GEOMETRY (Ma-14)—Rectilinear figures—the basic characteristics of triangles and quadrilaterals, congruency of triangles, parallel lines, interior and exterior angles of polygons with problems in loci. The circle—a consideration of its properties and the measurement of angles and arcs, problems in construction and loci. Proportion and similar polygons—properties of a proportion, condition for the similarity of rectilinear figures, numerical properties of figures with problems of construction. Areas of polygons—the triangle, the rectangle, the parallelogram, and the trapezoid, proportionate areas, problems of construction. Properties of regular polygons and mensuration of the circle.

Solid Geometry

(Ma-21x)

Following Plane Geometry and extending the principles of Plane Geometry to the geometry of three dimensional figures this course is very comprehensive. Only the great basic theorems and problems are considered and the exercises which form the most interesting part of the course have been very carefully chosen, the majority of them being of a highly practical nature.

Topics Covered in This Course:

SOLID GEOMETRY (Ma-15) — Lines and planes in space—dihedral and the polyhedral angles. Polyhedrons, cylinders and cones—the formulas for a lateral area and volume of prisms, parallelepipeds, pyramids, cylinders and cones developed. The sphere —generation of a spherical surface, plane sections and tangent planes, spherical polygons, the measurement of spherical surfaces and solids.

Plane Trigonometry

(Ma-22x)

In the preparation of this course the rule has been followed that the practical use of every new principle should be clearly understood by the student before the abstract theory is developed, and this is one of the factors that make the work so interesting and helpful. A wide range of practical problems is given and all that is unnecessary to a clear understanding of the subject is eliminated. To carry on this work successfully one should be well trained in Algebra and Plane Geometry.

Topics Covered in This Course:

PLANE TRIGONOMETRY (Ma-16)—The six functions defined and used in a wide range of practical applications of the right triangle. Logarithms—the use of logarithmic tables and the table of natural functions. Trigonometric functions of any angle. Functions of the sum or the difference of two angles. The oblique triangle—solved by the law of sines, the law of cosines and the law of tangents, the area of a triangle, Graphical representation of functions, the radian.

Spherical Trigonometry

(Ma-23x)

The chief object of spherical trigonometry is the solution of spherical triangles and in this course the principles of plane trigonometry are extended to cover right and oblique spherical triangles. The applications will be especially helpful for those students who wish to continue their studies in the fields of geodesy, navigation and astronomy. The student should be familiar with the principles of solid geometry.

Topics Covered in This Course:

SPHERICAL TRIGONOMETRY (Ma-17) — Classification and geometric properties of spherical triangles, the right spherical triangle solved. The oblique spherical triangle and the development of formulas for its solution and for determining its area.

Analytic Geometry, Plane

(Ma-32x)

This course will serve as a splendid preparation for those men who wish to continue their mathematical studies into the calculus and who are already proficient in arithmetic, algebra, geometry and trigonometry. Besides being one of the most interesting mathematical subjects in the curriculum it is especially valuable for the training it affords in the construction and interpretation of graphs. It opens to the student an entirely new method of approaching mathematical truths, and for this reason much stress is placed on the first lessons wherein are built those concepts and ideas on which future lessons are based. A great deal of emphasis is also given to those sections of the subject in which experience has shown the student of calculus to be most frequently deficient.

Topics Covered in This Course:

ANALYTIC GEOMETRY, PLANE (Ma-7)—Fundamental ideas discussed and developed. Rectangular, oblique and polar co-ordinates. Loci with discussion of an equation for intercepts, symmetry, extent and asymptotes in both rectangular and polar co-ordinates. Transformation of co-ordinates. The straight line. The circle. The parabola. The ellipse and the hyperbola. The general equation of the second degree with consideration of transcendental and parametric equations.

"I Will Study and Get Ready and Maybe My Chance Will Come."—Lincoln

Analytic Geometry, Three Dimensions

(Ma-24x)

In this course the concepts and ideas developed in Plane Analytic Geometry are extended to cover the geometry of space. It serves as a further preparation for the calculus.

Topics Covered in This Course:

ANALYTIC GEOMETRY, THREE DIMENSIONS (Ma-18)—Rectangular and polar coordinates in space. The locus of an equation discussed for symmetry, intercepts and intersections. Quadric surfaces. The equation of a plane in terms of its intercepts. The general equations of a straight line.

Differential Calculus

(Ma-25x)

In the study of the calculus the idea of change and variation will be brought out more clearly than in any lower mathematics. The manner in which a function changes in value as the independent variable changes is carefully investigated and the fundamental problem of the calculus is to establish a measure of this change. The subject matter is presented in a very interesting manner and special care has been taken to make the extent and nature of each new theorem perfectly clear. Graphical illustration has been drawn on very freely and the problems have been chosen in such a way as to illustrate the theory and at the same time to be of interest to the student. This course in calculus will bring into requisition all the mathematics up to and including analytical geometry.

Topics Covered in This Course:

DIFFERENTIAL CALCULUS (Ma-19)—Variables and functions. Theory of limits with fundamental theorems. Differentiation with applications to geometry. Rules for differentiation of standard elementary forms with simple applications of the derivative. Successive differentiation. Maxima and minima. Points of inflection and curve tracing. Differentials. Rates and change of variable. Theorem of mean value. Rules of curvature. Circle and center of curvature. Partial differentiation. Envelopes. Series. Expansion of functions. Asymptotes and singular points.

Integral Calculus

(Ma-26x)

The integral calculus is primarily the inverse of the differential calculus and taken both together they constitute one of the most powerful tools of the modern mathematician. This course follows Differential Calculus and is treated in the same interesting manner. The needs of the student pursuing a first course in the calculus have been kept constantly in mind and an effort has been made to present every new theorem as clearly and attractively as possible. A great many problems from different sciences have been selected for illustration and solution, but these problems do not presuppose an extended knowledge in any particular branch of science but are based on the knowledge that all students of calculus are supposed to have.

Topics Covered in This Course:

INTEGRAL CALCULUS (Ma-20)—Integration as the inverse of differentiation. Rules for integrating, standard elementary forms. The constant of integration, its geometric and physical significance. The definite integral. Integration—by substitution of a new variable, by rationalization. Integration as a process of summation. Successive and partial integration. Differential equation. Approximate integration. Trapezoidal rule. Parabolic rule. Centers of area and volume. Pressure of liquids.

Finds Instruction Superior and Explanations Easily Understood

I find the instruction and textbooks superior to any I have taken up and I have received practically all my education by the correspondence school route. The explanations are the first I have seen that were easily understood by the ordinary self-taught man. I sincerely believe that the Schools are doing a great work.—CLAUDE W. FENTON, Breckenridge, Texas.

GENERAL EDUCATION

A PERSON may be of value to his community or to the world, may be able to earn a good living; and yet lose much of the real satisfaction of life, and the full realization of his talents, because of the lack of a good general education.

Important as vocational training may be, it is not the whole of life. Men and women of culture, with broad educations, are respected and sought after wherever they go. Such people live richer, more fruitful lives, and help to make life worth more to others.

Unfortunately, thousands of men and women leave school before acquiring even a high school education, not to mention a college training. But today it is easy for the ambitious person to overcome this handicap through spare-hour study. The United Y.M.C.A. Schools, with a well organized division of correspondence instruction, can bring to every ambitious man and woman the advantages given in the past year to over 140,000 students.

The courses described in the following pages have been prepared by teachers whose practical training and experience have given them a clear insight into the educational needs of young men and women the country over. While engaged in their preparation, these teachers, moreover, were in close co-operation with many of the expert correspondence instructors who had prepared other courses described elsewhere in this catalog. As a result, short courses and standard high school programs have been developed to meet the varied needs of everyone.

Instruction

Clinton S. Marsh, Assistant Supervisor of Instruction, directs the work of the General Education Department. For more than twenty years Mr. Marsh taught and supervised country, village, and city schools, directed large numbers of teachers in their preparation for examinations for certificates, and advised pupils in preparation for colleges, universities, and professional schools. He was educated in district (farms) schools, the Cortland (N.Y.) State Normal School, Cornell University, and Sorbonne University and the Musée Pedagogique in Paris. He has also taken occasional lectures at Teachers College of Columbia University.

The work of the General Education Department is being developed on a high plane through the employment of a resident corps of experienced teachers and experts, all of whom are graduates of leading colleges, universities, and schools of pedagogy.

Assisting Mr. Marsh as advisors and writers of special texts are capable, well-known teachers such as Professor Seymour Handy, B.A., a graduate of Syracuse University, post-graduate of Teachers College of Columbia University, and for eight years acting as authority and examiner for the Regents Department of the State of New York, in American History; Henry S. Richards, B.S., M.A., examiner in Chemistry for the State Regents Board and for the College Entrance Board and Head of the Department of Chemistry in the High School of Yonkers, N.Y.; Dr. John C. Hubbard, Head of the Department of Physics, New York University. Johanna deWolf, B.A., assists Mr. Marsh in the work of the Department and has special direction of the Departments of English, History and Pedagogy.



C. S. MARSH

General High School

(Ac-58x-Ge)

The first step necessary for the man or woman who determines to accomplish something worth while in life is to acquire a good high school training, or its equivalent. Ambitious men and women will find in the following program an opportunity to secure a knowledge of the many things which place advantage and position in the hands of the high school graduate. It also provides an excellent means of obtaining the necessary preliminary training to enter college. The range of subjects is comprehensive and a liberal choice has been provided to meet individual needs or to conform to any particular educational requirements.

An introductory group of subjects has been included for those who may need extra preparation. This preliminary work is intended to give all those who desire the advantages of a high school education a chance to realize their ambition.

Subjects Covered in This Course:

Introductory Group

* *OPTIONAL—Choose ANY or ALL of the following subjects:*

ENGLISH GRAMMAR FOR BEGINNERS (Ac-1)—Pronunciation. Spelling. Parts of speech. Sentence elements. Capitalization. Punctuation. Paragraphing. Letter writing.

GRAMMAR SCHOOL ARITHMETIC (Ma-27)—Fundamental operations. Fractions. Weights and measures. Practical measurements. Percentage. Business applications. Ratio and proportion. Powers and roots. Arithmetical and geometrical progressions.

CIVICS: AMERICAN GOVERNMENT AND CITIZENSHIP (Ac-11)—Human needs and the government. Nature of modern government. National, state, municipal and rural government. Elements of community welfare. Financial, economic, industrial and social problems.

ELEMENTARY GEOGRAPHY (Ac-23)—The United States and foreign countries; their industries, commerce, and physical features. The earth; latitude and longitude. Winds. Rain. Ocean movements. Plants, animals, and peoples of the earth.

ELEMENTARY HISTORY OF THE U. S. (Ac-41)—European beginnings in America. Coming of the English. Growth of colonies. War of the Revolution. Early republic. Rise of the Middle West. Civil War. National Development. United States in the World War.

GENERAL SCIENCE (Ac-25)—Air, fire, water, food and their uses to mankind. The forces of nature. Homes and clothing. Work with everyday machines. Life—its origin and betterment.

First Year

ENGLISH GRAMMAR AND COMPOSITION (Ac-3)—Word formation. Sentence correction. Grammar. Punctuation. Paragraphing. Letter writing. Four principal types of composition.

ELEMENTARY ALGEBRA (Ma-11)—Fundamental operations. Simple and simultaneous equations. Graphical solution of equations. Involution and evolution. Theory of exponents and imaginary numbers.

†**BIOLOGY** (Ac-16)—Composition of living and lifeless things. Foods, plants, animals, and the human body. Structures, adaptations, and functions of organs.

ELECTIVE—Choose ONE of the following subjects:

WORLD'S HISTORY TO 1789 (Ac-29)—Early, middle, and late stone ages. Egypt. Babylonia. Assyria. Chaldea. Medo-Persian Empire. Hebrews. Dawn of European Civilization. Athens in the age of Pericles. Alexander the Great. Hellenistic age. Romans—conquests, world dominion and degeneracy, end of the republic, empire. German invasions. Rise of Papacy. Mohammedans. Charlemagne. Feudalism. England in the Middle Ages. Crusades. Medieval civilization. Protestant revolt and the wars of religion. Martin Luther. Seventeenth and Eighteenth centuries—struggle in England between King and Parliament, France under Louis XIV, Russia, Prussia.

ANCIENT HISTORY (Ac-33)—Egypt. Tigris-Euphrates states. Phoenicians. Hebrews. Persian Empire. Greeks—Prehistoric Hellas, Cretan civilization, Homeric Age, Persian wars, Athenian leadership, age of Pericles, fall of Athens. Alexander and his conquests. Mingling of the East and West. Rome—land and peoples, legendary history, unification of Italy, government of the republic, conquests, Pompey and Cæsar, the empire. Rise of Christianity. Teutons. Wanderings of the peoples. Dark Ages. Western Europe. Empire of Charlemagne.

OPTIONAL—Choose ONE of the following subjects, if desired:

FIRST YEAR LATIN (Ac-6)—Nouns. Adjectives. Adverbs. Pronouns. Regular and irregular verbs. Rules of syntax. Exercises in word formation and derivation. Easy reading selections.

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* *Optional.* (*See page* 12.)

† *A box of apparatus and chemicals will be sent for performing the experiments.*

ELEMENT'Y FRENCH, with Rec'ds (ML-32).
ELEMENT'Y GERMAN, with Rec'ds (ML-37).
ELEMENT'Y ITALIAN, with Rec'ds (ML-40).
ELEMENT'Y SPANISH, with Rec'ds (ML-31).

A comprehensive study of grammar together with numerous conversational lessons calculated to enable the student to speak the language and to understand the construction of the sentence. Reading lessons.

Second Year

ENGLISH COMPOSITION (Ac-4)—Diction, sentence mutation. Grammar. Letter writing. Narration. Description. Exposition. Argumentation. Figures of speech. Meter.

PLANE GEOMETRY (Ma-14)—Characteristics of rectilinear figures. The circle, the triangle and other polygons. Similar figures. Areas of polygons. Properties of regular polygons and mensuration.

ELECTIVE—Choose ONE of the following subjects:

WORLD'S HISTORY 1789 TO 1920 (Ac-14)—Conditions and reforms in the eighteenth century. French revolution and Napoleon. Reconstruction of Europe at the Congress of Vienna. Revolution of 1848 in France, Austria, Germany, Italy. Formations of Italy, German Empire, Austria-Hungary. Reforms in Europe before the World War. Expansion of Europe. Spread of western civilization. British Empire, Russian Empire, Turkey and the Eastern question. European interests in the Far East. Europe in the opening years of the Twentieth Century. The World War. The Russian Revolution. Reconstruction of Europe. Europe after the World War.

MODERN HISTORY (Ac-38)—Brief review of ancient history. Transition period from ancient to modern history. East and the Crusades. The Renaissance. Reformation in England. Colonial England. France and the age of Louis XIV. Balance of power in Europe and the great struggle for colonial supremacy. Rise of Prussia and Russia. French Revolution. Napoleon and the Napoleonic Wars. Congress of Vienna. Empire of Germany. Russian Empire in the 19th Century. Near Eastern question. Triple Alliance. Entente. World War. Treaty of Peace of 1919. Conference for the limitation of Armament.

ELECTIVE—Choose ONE of the following subjects:

PHYSICAL GEOGRAPHY (Ac-24)—The earth and the solar system. Surface features of the earth. Crustal movements and vulcanism. Climate. The earth's magnetism. The ocean. Distribution of life maps.

***GENERAL SCIENCE** (Ac-25)—Air, fire, water, food and their uses to mankind. The forces of nature. Homes and clothing. Work with everyday machines. Life—its origin and betterment.

COMMERCIAL GEOGRAPHY (Ac-10)—The United States and foreign countries. Climate and topography. Industries. Manufactures. Trade and trade routes. World commerce. Law of trade. Expansion of industry and resources. The world highway.

NOTE: With the sixth lesson a year's subscription to the National Geographic Magazine is sent.

OPTIONAL—Choose ONE of the following subjects if desired:

CAESAR'S GALLIC WARS (Ac-7)—Translation—Four books of Cæsar's Gallic Wars. Review of grammar. Composition exercises. Exercises in word formation and derivation.

ELEMENTARY MODERN LANGUAGE (Continued).

Third Year

ENGLISH LITERATURE (Ac-5)—Criticism of works of standard authors. Writing of at least six hundred words of composition with each lesson. Reference books—History of English literature. Old Testament selections. Shakespeare, Scott, Dickens, Eliot, Carlyle. Other standard English authors.

ELECTIVE—Choose ONE of the following subjects:

WORLD'S HISTORY: AMERICAN HISTORY (Ac-15)—Discovery and Exploration. Colonization. Colonial history. Independence, 1775-1783. The Constitution 1783-1789. Federalist supremacy, 1789-1800. Jeffersonian republicans, 1801-1812. War and peace, 1812-1829. National democracy, 1829-1844. Slavery in the territories. Secession. Civil War. Reconstruction. National development. United States in our own times. The great war.

ENGLISH HISTORY (Ac-36)—Early Britain to 449 A. D. Saxon England 449-1066. Norman England 1066-1154. England under the Plantagenets, 1154-1485. Tudor England 1485-1603. Puritan Revolution and Royalist reaction, 1603-1688. Constitutional monarchy, 1688-1820. British Empire 1820-1921. Anglo-American relations. Irish question. England in the World War.

ELECTIVE—Choose TWO of the following subjects: THREE may be taken if desired, but only ONE Modern Foreign Language can be included.

INTERMEDIATE ALGEBRA (Ma-12)—Quadratics. Graphical solutions emphasized. Properties of quadratics. Inequalities. Ratio and proportion. Binomial theorem. Logarithms and complex numbers.

SOLID GEOMETRY (Ma-15)—Lines and planes in space-dihedral and polyhedral angles. Polyhedrons, cylinders and cones—lateral area and volume of prisms, parallelepipeds, pyramids, cylinders and cones. The sphere. Measurement of spherical surfaces and solids.

* *A box of apparatus and chemicals will be sent for performing the experiments.*

ELEMENT'Y FRENCH, with Rec'ds (ML-32).

ELEMENT'Y GERMAN, with Rec'ds (ML-37).

ELEMENT'Y ITALIAN, with Rec'ds (ML-40).

ELEMENT'Y SPANISH, with Rec'ds (ML-31). A comprehensive study of grammar together with numerous conversational lessons calculated to enable the student to speak the language and to understand the construction of the sentence. Reading lessons.

CICERO'S ORATIONS (Ac-8)—Translation. First Oration against Catiline. Second Oration against Catiline. Third Oration against Catiline. Manilian Law. Defense of Archias. Grammar and Composition.

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary equipment, including instruments, furnished—no additional cost.

†**CHEMISTRY** (Ac-42)—The chemist and matter. Laws, theories, formulas, and equations. The elements and their compounds—their properties—physical and chemical.

Fourth Year

CIVICS: GOVERNMENT AND POLITICS IN THE UNITED STATES (Ac-39)—Local governments. State governments. The national government. Powers of Congress. Federal judiciary. Constitutional protection of business and personal rights. The party. Public opinion. Civil service. Direct legislation.

ELECTIVE—Choose THREE of the following subjects. FOUR may be taken if desired.

VIRGIL'S AENEID (Ac-9)—Translation. Aeneid, books I, II, III, IV, VI. Grammar and Composition. Versification. Content. Style, Appreciation.

ADVANCED MODERN LANGUAGE. French, German, Spanish, or Italian.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Ellipse. Perspective of elliptical objects. Parallel perspective. Angular perspective. Object drawing. Perspective renderings. Light and shade. Value of line. Building sketches. Landscape composition.

ADVANCED ALGEBRA (Ma-13)—Properties of quadratic equations discussed in detail. Indeterminate equations. Ratio, proportion and variation. Progressions. Binomial theorem. Logarithms. Variables and limits. Series. Determinants. Graphical representation of functions. Transformation of equations. Commensurable and incommensurable roots. Horner's method of approximation. General solution of equations. Complex numbers.

PLANE TRIGONOMETRY (Ma-16)—The six functions defined and used. Logarithms. Trigonometric functions of any angle. Functions of the sum or the difference of two angles. The oblique triangle—the law of sines, the law of cosines and the law of tangents. Graphical representation of functions.

GENERAL GEOLOGY (Ac-21)—Subdivision of geology and methods of geologic study. Minerals. Rocks. Volcanic phenomena. Sorting and disposition of rock material. Earth movements. Elementary mapping.

HISTORY OF EDUCATION (Ac-32)—Primitive, Oriental, Greek and Roman Education. Education of the Middle Ages, Renaissance, Reformation. Modern tendencies. Rise, growth and comparison of the national systems of education in England, France, Germany, Italy, and the United States.

EDUCATIONAL PSYCHOLOGY (Ac-34)—The migratory, food getting, ownership, and gregarious instincts. Effect of child behavior on the four principal emotions. Special studies of heredity and the inheritance of acquired characteristics. Environment. Moral development. Individual differences.

†**PHYSICS** (Ac-43)—Weights and measures. Work. Mechanics of liquids and gases. Force and motion. Strength of materials. Energy. Heat. Electricity. Sound. Light.

**Optional.* (*See Page* 12.)

† *Helpful experiments are included in the lessons. These experiments are optional. Students who desire, may purchase a suitable laboratory outfit from us at cost. Price on application.*

Commercial High School

(AC-58x-Co)

The trend of ambition among many young men and women is strongly in the direction of business. But more than an ordinary grammar school or general high school education is required to enter the business world by way of positions that promise advancement and good salaries.

The young man or woman who knows how business is conducted, how the various transactions are made and recorded, and the reasons underlying these things, stands a better chance to rise. Experience is necessary, but without preliminary training and knowledge of business principles acquired through study, it loses much of its value.

This Commercial High School Course combines fundamental business subjects with such other studies as will give the student a well-rounded, high school education. An introductory group of subjects is included for those who may need extra preparation. This preliminary work will give those who desire a commercial high school education an opportunity to realize their ambition.

Subjects Covered in This Course:

Introductory Group

***OPTIONAL—Choose ANY or ALL of the following subjects:*

ENGLISH GRAMMAR FOR BEGINNERS (Ac-1)—Pronounciation. Spelling. Parts of speech. Sentence elements. Capitalization. Punctuation. Paragraphing. Letter writing.

GRAMMAR SCHOOL ARITHMETIC (Ma-27)—Fundamental operations. Fractions. Weights and measures. Practical measurements. Percentage. Business applications. Ratio and proportion. Powers and roots. Arithmetical and geometrical progressions.

ELEMENTARY HISTORY OF THE U. S. (Ac-41)—European beginnings in America. Coming of the English. Growth of colonies. War of the Revolution. Early republic. Rise of the Middle West. Civil War. National development. United States in the World War.

ELEMENTARY GEOGRAPHY (Ac-23)—The United States and foreign countries; their industries, commerce, and physical features. The earth; latitude and longitude. Winds. Rain. Ocean movements. Plants, animals, and peoples of the earth.

First Year

ENGLISH GRAMMAR AND COMPOSITION (Ac-3)—Word formation. Sentence correction. Grammar. Punctuation. Paragraphing. Letter writing. Four principal types of composition.

CIVICS: AMERICAN GOVERNMENT AND CITIZENSHIP (Ac-11)—Human needs and the government. Nature of modern government. National, state, municipal and rural government. Elements of community welfare. Financial, economic, industrial and social problems.

BUSINESS ARITHMETIC (Co-11)—Fundamental operations. Percentage, interest, banking, dividends and investments as employed in business organizations large and small.

COMMERCIAL GEOGRAPHY (Ac-10)—The United States and foreign countries. Climate and topography. Industries. Manufactures. Trade and trade routes. World commerce. Law of trade. Expansion of industry and resources. The world highway.

NOTE: With the sixth lesson a year's subscription to the National Geographic Magazine is sent to the student.

PENMANSHIP (Co-12)—Correct positions in writing. Definition of movement. Rapid, plain, coarse-pen, muscular-movement writing for business or social use.

Second Year

ENGLISH COMPOSITION (Ac-4)—Diction, sentence mutation. Grammar. Letter writing. Narration. Description. Exposition. Argumentation. Figures of speech. Meter.

BOOKKEEPING (Co-10)—Single entry. Double entry. Types of accounts. Posting. Recording in journal. Types of journals. Outline of accounts used in partnership. Accruals and deferred items. Manner of corporation organization. Exhibits and schedules. Corporation Bookkeeping and accounting. Advantages of cost system. Important features of cost systems. Books of account.

WORLD'S HISTORY TO 1789 (Ac-29)—Stone age. Egypt. Babylonia. Assyria. Chaldea. Medo-Persian Empire. Hebrews. Dawn of European civilization. Greece. Rome. Rise of Papacy. Medieval civilization. Seventeenth and Eighteenth centuries—struggle in England between King and Parliament. France. Russia. Prussia.

ELECTIVE—Choose ONE or TWO of the following subjects. Only ONE Language may be selected.

ELEMENT'Y FRENCH, with Rec'ds (ML-32).

ELEMENT'Y SPANISH, with Rec'ds (ML-31).

ELEMENT'Y GERMAN, with Rec'ds (ML-37).

ELEMENT'Y ITALIAN, with Rec'ds (ML-40). A comprehensive study of grammar together with numerous conversational lessons calculated to enable the student to speak the language and to understand the construction of the sentence. Reading lessons.

ELEMENTARY ALGEBRA (Ma-1)—Fundamental operations. Simple and simultaneous equations. Graphical solution of equations. Involution and evolution. Theory of exponents and imaginary numbers.

TYPEWRITING (Co-13)—Mastery of the keyboard. Typewriting technique. Accuracy drills. Speed drills. Correspondence.

At the time he enrolls, student should specify what make of typewriter he intends to use.

Third Year

ADVANCED BUSINESS ENGLISH AND CORRESPONDENCE (Co-9)—Parts of speech. Punctuation. Style of business English. Correctness and force in sentence structure. Correctness and force in dictation. Business forms and usages. Mechanical make-up of letter. Official and social forms. Essential qualities of business letter. Construction of letter. Routine letters. Claims and adjustment letters. Collection letters. Sales letters. Follow-up letters. Advertising copy. Business narrative. Filing system.

BUSINESS LAW (Co-1)—Principles of contract. Operation and discharge of contracts. Contracts concerning goods. Bailment of goods. Contracts concerning credits. Conduct of business through representatives. Partnerships. Corporations. Real property. Personal property.

**Optional.* (*See Page* 12.)

"The prizes in business today go to the men who keep profitably busy as a result of their own initiative"—Babcox

ELECTIVE—Choose ONE or TWO of the following subjects. Only ONE Shorthand Course may be selected.

ISAAC PITMAN SHORTHAND (Co-19)—The original system of phonography. Practice in speed. Practice in accuracy. Building up a complete vocabulary.

GRAHAM SHORTHAND (Co-18)—Building up a complete working knowledge of the system. Practice in accuracy, and in speed.

GREGG SHORTHAND (Co-14)—A light-line system. No shading. No dots, dashes or position writing. Practice in accuracy, and speed.

WORLD'S HISTORY 1789 to 1920 (Ac-14)—Conditions and reforms in the Eighteenth century. French Revolution and Napoleon. Reconstruction of Europe. Reforms in Europe. Before the World War. Expansion of Europe. Spread of western civilization. Europe in the opening years of the Twentieth century. The World War. The Russian Revolution. Reconstruction of Europe. Europe after the World War.

PLANE GEOMETRY (Ma-14)—Characteristics of rectilinear figures. The circle, the triangle and other polygons. Similar figures. Areas of polygons. Properties of regular polygons and mensuration.

†**CHEMISTRY** (Ac-42)—The chemist and matter. Laws, theories, formulas, and equations. The elements and their compounds—their properties—physical and chemical.

‡**BIOLOGY** (Ac-16)—Composition of living and lifeless things. Foods, plants, animals, and the human body—characteristics, structures, adaptations, and functions of organs.

BOOKKEEPING (Co-10)—Continued.

Fourth Year

BUSINESS ECONOMICS (Co-5)—Underlying conditions of national prosperity. Primary factors of production, labor, power, land, capital. Productive industries. First law of the market. Relation of utility to value. Banking. Marketing. "Free-trade." "Protectionism." Distribution of wealth. Wages. Labor organization. Rent of land. Source of interest. Cost of capital. Profits. Consumption of wealth. Rational consumption. Luxury. Taxation. Financing of war. Communism. Socialism. Anarchism. Constructive liberalism.

OFFICE MANAGEMENT (Co-7)—Principles of office administration. Selection of an office. Layout and flow of work. Labor saving devices. Methodizing means of communication. Control of correspondence and related activities. Handling office detail. Work of business departments, advertising, accounting, sales. Training and developing of office workers. Business writing. Business speech.

WORLD'S HISTORY: AMERICAN HISTORY (Ac-15)—Discovery and exploration. Colonization. Colonial history. Independence, 1775-1783. The Constitution, 1783-1789. Federalist supremacy, 1789-1800. Jeffersonian republicans, 1801-1812. War and Peace, 1812-1829. National democracy, 1829-1844. Slavery in the territories. Secession. Civil War. Reconstruction. National development. United States in our own times. The great war.

OPTIONAL—Choose ONE or TWO of the following subjects if desired. Only ONE language may be selected.

†**PHYSICS** (Ac-43)—Weights and measures. Work. Mechanics of liquids and gases. Force and motion. Strength of materials. Energy. Heat. Electricity. Sound. Light.

ENGLISH LITERATURE (Ac-5)—Criticism of works of standard authors. Composition. Reference books—History of English literature. Old Testament selections. Shakespeare, Scott, Dickens, Eliot, Carlyle. Other standard English authors.

ADV. FRENCH, COMMERCIAL (ML-34).
ADV. SPANISH, COMMERCIAL (ML-35).
ADV. GERMAN, COMMERCIAL (ML-39).
ADV. ITALIAN, COMMERCIAL (ML-42).
Composition. Drill in idioms. Translations. Commercial correspondence. Recognized commercial modes of expression. Banking operations. Making out of shipping documents and invoices. Commission business. Transportation.

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment including instruments, furnished—no additional cost.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications and renderings. Object drawing. Light and shade. Building sketches. Landscape composition.

SHORTHAND—Continued.

**Optional.* (*See Page* 12.)

† *Helpful experiments are included in the lessons. These experiments are optional. Students who desire, may purchase a suitable laboratory outfit from us at cost. Price on application.*

‡ *A box of apparatus and chemicals will be sent for performing the experiments.*

Trade High School

(AC-58xTr)

Are you one of thousands of young men who feel the need of a high school course, but who must earn your living at some trade? Many a man with a good general education has found it difficult to make ends meet because of a lack of specialized knowledge. Many a good trades worker feels the hardship to himself and his family which results from a lack of the education necessary to make the most out of life. If you are without a high school education and expect to earn your living through one of the trades, this Trade High School Course is your opportunity. Even if you have not completed your grammar school education, you can take advantage of it.

Release Your Abilities from Bondage

Note the introductory group of subjects for those who have not yet the education to carry through the lessons of high school subjects successfully. Any or all of these subjects may be taken without additional charge.

Subjects Covered in This Course:

Introductory Group

**OPTIONAL—Choose ANY or ALL of the following subjects:*

ENGLISH GRAMMAR FOR BEGINNERS (Ac-1)—Pronunciation. Spelling. Parts of speech. Sentence elements. Capitalization. Punctuation. Paragraphing. Letter writing.

GRAMMAR SCHOOL ARITHMETIC (Ma-27)—Fundamental operations. Fractions. Weights and measures. Practical measurements. Percentage. Business applications. Ratio and proportion. Powers and roots. Arithmetical and geometrical progressions.

ELEMENTARY HISTORY OF THE U. S. (Ac-41)—European beginnings in America. Coming of the English. Growth of colonies. War of the Revolution. Early republic. Rise of the Middle West. Civil War. National development. United States in the World War.

ELEMENTARY GEOGRAPHY (Ac-23)—The United States and foreign countries; their industries, commerce, and physical features. The earth; latitude and longitude. Winds. Rain. Ocean movements. Plants, animals, and peoples of the earth.

First Year

ENGLISH GRAMMAR AND COMPOSITION (Ac-3)—Word formation. Sentence correction. Grammar. Punctuation. Paragraphing. Letter writing. Four principal types of composition.

CIVICS: AMERICAN GOVERNMENT AND CITIZENSHIP (Ac-11)—Human needs and the government. Nature of modern government. National, state, municipal and rural governments. Community life. Elements of community welfare. Financial, economic, industrial and social problems.

PHYSICAL GEOGRAPHY (Ac-24)—The earth and the solar system. Surface features of the earth. Crustal movements and vulcanism. Climate. The earth's magnetism. The ocean. Distribution of life maps.

ELECTIVE—Choose ONE subject (Ma-5) or TWO subjects (Ma-1) and (Ma-2).

SHOP ARITHMETIC (Ma-5)—Interesting shop problems, clear explanations and simple calculations. The arithmetic necessary for the work in the shop.

NOTE: Students taking (Ma-5) should continue their mathematics by taking (Ma-6).

ARITHMETIC (Ma-1)—Practical problems, helpful explanations and calculations involving arithmetic only. Practical considerations emphasized throughout.

NOTE: Students taking (Ma-1) and (Ma-2) should continue their mathematics by taking (Ma-3) and (Ma-4).

GEOMETRY (Ma-2)—Explanations, problems, and calculations having to do with Plane surfaces and solids. Simple formulas and the use of letters in them. Graphic methods.

ELECTIVE—Choose ONE subject (Dr-45) or TWO subjects (Dr-42) and (Ar-12).

ESSENTIALS OF DRAFTING (Dr-45)—Practice in the use of instruments. Freehand lettering. Projections. Sections. Developments and intersections of surfaces. Pictorial representation. Machine fastenings. Pipes. Sketching.

All necessary drawing equipment, including instruments, furnished—no additional cost.

ESSENTIALS OF DRAFTING (Dr-42)—Geometrical drawing. Drawing instruments and materials and their uses. Tracing. Geometrical problems. Conic sections. Orthographic projection. Development of surfaces. Intersection of surfaces. Isometric and oblique projection.

All necessary drawing equipment, including instruments, furnished—no additional cost.

FREEHAND LETTERING (Ar-12)—Letter construction. General proportions. Shading. Roman letters. Old Roman. Modern Roman. Commercial Gothic. Single-stroke letters. Composition and titles.

Second Year

ENGLISH COMPOSITION (Ac-4)—Diction, sentence mutation. Grammar. Letter writing. Narration. Description. Exposition. Argumentation. Figure of speech. Meter.

†**CHEMISTRY** (Ac-42)—The chemist and matter. Laws, thories, formulas, and equations. The elements and their compounds—their properties—physical and chemical.

ELECTIVE—Choose ONE subject (Ma-6) or the TWO subjects (Ma-3) and (Ma-4).

ADVANCED SHOP MATHEMATICS (Ma-6)—Formulas and how to use them. How to use tables and charts. Geometric constructions for the man in the shop. Trigonometry as used in practical problems.

ALGEBRA (Ma-3)—Thorough work in this subject made interesting by practical problems. Instruction necessary in order to deal with formulas and equations. Graphs and how to make them.

TRIGONOMETRY (Ma-4)—Logarithms. Trigonometry in its varied uses in the engineering field. Some of the more important graphical problems.

**Optional.* (*See Page* 12.)

† *Helpful experiments are included in the lessons. These experiments are optional. Students who desire, may purchase a suitable laboratory outfit from us at cost. Price on application.*

ELECTIVE—Choose ONE of the following subjects:

MECHANICAL WORKING DRAWING (Dr-47)—Working drawings of objects. Correct dimensioning of drawings. Sectioning. Detailing from assemblies. Making assembly drawings from details.

ARCHITECTURAL DRAWINGS (Ar-16)—Sketch plans. Architectural symbols. Stairway circulation. Working drawings of a brick house. Working drawings of a frame house. Floor plans. Elevations. Sections. Scale and full-size details. Analysis of several existing drawings.

ELECTIVE—Choose ONE of the following subjects:

WORLD'S HISTORY TO 1789 (Ac-29)—Stone age. Egypt. Babylonia. Assyria. Chaldea. Medo-Persian Empire. Hebrews. Dawn of European civilization. Greece. Rome. Rise of Papacy. Medieval civilization. Seventeenth and Eighteenth centuries. Struggle in England between King and Parliament. France. Persian Empire. Greeks—Prehistoric Hellas, Cretan civilization, Homeric Age, Persian wars, Athenian leadership, age of Pericles, fall of Athens. Conquests of Alexander. Rome—land and peoples, legendary history, unification of Italy, government of the republic, conquests, Pompey and Cæsar, the empire. Rise of Christianity. Teutons. Wanderings of the peoples. Dark Ages. Western Europe. Empire of Charlemagne.

ANCIENT HISTORY (Ac-33)—Egypt. Tigris-Euphrates states. Phoenicians. Hebrews.

Third Year

†**PHYSICS** (Ac-43)—Weights and measures. Work. Mechanics of liquids and gases. Force and motion. Strength of materials. Energy. Heat. Electricity. Sound. Light.

*__ENGLISH LITERATURE__ (Ac-5)—Criticism of works of standard authors. Writing of at least six hundred words of composition with each lesson. Reference books—History of English literature. Old Testament selections. Shakespeare, Scott, Dickens, Eliot, Carlyle. Other standard English authors.

ELECTIVE—Choose ONE of the following subjects:

MACHINE WORKING DRAWING (Dr-46)—Working drawings of complex machine details. Study of dimensioning as related to drawing room, pattern shop and machine shop. Assembly drawings from details. Assembly and general shop notes.

FREEHAND DRAWING (Ar-13)—Pencil technique. Perspective principles, applications, and renderings. Parallel perspective. Angular perspective. Object drawing. Building sketches. Landscape composition.

MACHINE SKETCHING (Dr-48)—Training in the sketching of machine parts. Sketches of machine details, sections and assemblies. Assembly sketches from machine details

ELECTIVE—Choose ONE of the following subjects:

MECHANICS (CE-11)—Components, resultants and equilibrium of forces. Center of gravity. Moment of inertia. Machines. Uniform motion. Accelerated motion. Centrifugal force. Laws of falling bodies. Potential and kinetic energy.

BUILDING MATERIALS (Ar-3)—Cements. Mortars. Concrete. Brick. Stone. Terra cotta. Cast iron. Steel. Wood. Fireproofing materials. Reinforced concrete. Plumbing and drainage materials. Plaster. Interior trim. Paint. Roofing tile.

ELECTRICITY AND MAGNETISM (EE-5)—Electromotive force, current, and resistance. Electrical circuits. Nature and properties of magnetism. Magnetic circuits. Electromagnetic induction. Principles of direct currents. First studies in alternating currents. Batteries, electrolysis, and the electrochemical industries.

APPLIED ELECTRICITY FOR PRACTICAL MEN (EE-7)—Current. Resistance. Electro-motive force. Magnetism. Direct current generators, parts and windings. Heating and power. D.C. motors and controllers. Resistance. Alternating currents. Transformers. Polyphase principles. Alternators. A.C. motors. Controllers. Synchronous converter. A.C. and D.C. motor troubles. Storage batteries. Illumination. Lamps, reflectors. Wiring.

ELECTIVE—Choose ONE of the following subjects:

WORLD'S HISTORY, 1789 to 1920 (Ac-14)—Conditions and reforms in the Eighteenth century. French Revolution and Napoleon. Reconstruction of Europe. Reforms in Europe Before the World War. Expansion of Europe. Spread of western civilization. Opening years of Twentieth century. World War. Russian Revolution. Reconstruction of Europe. Europe after the World War.

WORLD'S HISTORY: AMERICAN HISTORY (Ac-15)—Discovery and exploration. Colonization. Colonial history. Independence, 1775-1783. The Constitution, 1783-1789. Federalist supremacy, 1789-1800. Jeffersonian republicans, 1801-1812. War and peace, 1812-1829. National democracy, 1829-1844. Slavery in the territories. Secession. Civil War. Reconstruction. National development. United States in our times. The great war.

ENGLISH HISTORY (Ac-36)—Early Britain to 449 A. D. Saxon England, 449-1066. Norman England, 1066-1154. England under the Plantagenets, 1154-1485. Tudor England, 1485-1603. Puritan Revolution and Royalist reaction, 1603-1688. Constitutional monarchy, 1688-1820. British Empire, 1820-1921. Anglo-American relations. Irish question. England in the World War.

Fourth Year

ELECTIVE—Choose any TWO of the following subjects:

APPLIED ELECTRICITY FOR PRACTICAL MEN (EE-7)—Continued.

BUILDING CONSTRUCTION (Ar-4)—Foundations. Arches. Structural work. Wooden framing. Interior trim. Standard mill construction. Fireproof construction. Reinforced concrete. Heating and ventilation. Plumbing and drainage. Gas piping. Electric lighting. Roofing. Lathing and plastering. Painting and decorating.

* *Optional.* (*See Page* 12.)

† *Helpful experiments are included in the lessons. These experiments are optional. Students who desire, may purchase a suitable laboratory outfit from us at cost. Price on application.*

ESTIMATING AND COST KEEPING (Ar-6) Ten laws of management. Rules of securing minimum cost. Piece rate. Bonus. Other systems. Measuring output of workmen. Quantity survey. Cost keeping. Office appliances and methods. Bookkeeping for small cost. Miscellaneous cost department blanks. Practical problems.

PLANE SURVEYING (CE-3)—Definitions. Adjustment and the use of level, transit and other instruments. Survey computations. Determination of meridian, latitude, longitude and time. Magnetic declination. Private and U. S. public land surveys. Mapping. Topographic, hydrographic and city surveys. Earthwork surveys and computations. The judicial functions of the surveyor.

PLAIN CONCRETE CONSTRUCTION (CE-13)—Specifications and tests. Forms. Mixing and handling. Waterproofing and coloring. Reinforced concrete and its strength. Stucco and plaster work. Precast concrete shapes. Sidewalks. Floors. Roads. Tanks. Cisterns. Silos. Small highway bridges and culverts.

WIRING PRACTICE (EE-27)—Wire and wiring material. Wiring systems. Selection of the wiring system for a job. Costs. Methods of installing each system. Alternating and direct-current circuits. Code requirements regarding the loading of circuits. Motors and generators, principles, operation troubles and remedies. Electric illumination, principles, lamps, reflectors, typical layouts, maintenance. Contracts and specifications.

NOTE: Students who have already taken the subject Applied Electricity for Practical Men (EE-7) will not desire to take this subject.

MACHINE SHOP TOOLS AND METHODS (ME-14)—Measuring instruments and their use. Engine lathes, screw cutting machines. Shapers. Slotters. Milling machines. Boring and drilling machines. Gear cutting machines. Key seating machines. Grinding machines. Cutting tools. Speeds and feeds.

BLACKSMITHING AND FORGING (ME-12)—Tools and equipment. Welding. Calculation of stock. Upsetting. Drawing out and bending. Steam hammer work. Forming dies. Drop forging. Miscellaneous forging operations, tempering, brazing, shrinking. Pipe bending. Heat treatment of steel. High-speed steel and its manipulation.

FOUNDRY PRACTICE (ME-13)—Methods of molding. Working with green sand, dry sand, and loam. Methods of molding as applied to steel, brass, bronze, malleable and chilled iron. Stresses due to contracting in molding. Molding machines. Die casting.

PATTERNMAKING (ME-16)—Uses of the principal varieties of timber. Seasoning. Shrinkage. Preservation of timber. Patterns and their relation to molding. Equipment for patternmaking.

PLUMBING (ME-8)—Plumbing tools and materials. Joints and connections. Use of soldering iron. Wiped joints. Work with tile, cast-iron and screwed pipes. House draining systems. Sewer systems. Water supply systems. Hot water supply. House heating.

ELECTIVE—Choose ONE of the following Subjects:

MACHINE DRAWING (Dr-9)—Drawings of such parts as couplings, pulleys, gears, riveted joints, screw threads, springs, pipe fittings, bearing boxes, valves, stuffing boxes, pistons, cross-heads, connecting rods, cranks, eccentrics and straps.

ELECTRICAL DRAWING (EE-18)—Lesson-notes and blueprints supply the instruction and data needed for each drawing. Motor Drawings—Complete assembly and detail drawings of a standard electric motor. Projections. Dimensions. Standard conventions. Wiring Plans and Diagrams—Conventional symbols. Typical diagrams used by representative electrical manufacturers. Standard symbols for wiring plans. Typical plans.

CIVIL ENGINEERING DRAWING (CE-24)—Conventional signs and symbols. Foundation plans. Topographical maps. Highway and railroad maps. City plants. Profiles. Cross sections.

ELEMENTARY PERSPECTIVE (Ar-10)—Perspective representation of objects. Planes. Vanishing points. Vanishing line of horizontal planes. Cone of vision. Plans and elevations of objects. Plan method. Height line. Rectilineal solids. Curved solids. Measuring point method. Practical methods.

OPTIONAL—Choose ONE if desired:

WORLD'S HISTORY: AMERICAN HISTORY (Ac-15)—Discovery and exploration. Colonization. Colonial history. Independence, 1775-1783. The Constitution, 1783-1789. Federalist supremacy, 1789-1800. Jeffersonian republicans, 1801-1812. War and peace, 1812-1829. National democracy, 1829-1844. Slavery in the territories. Secession. Civil War. Reconstruction. National development. United States in our own times. The great war.

MODERN HISTORY (Ac-38)—Brief review of ancient history. Transition period from ancient to modern history. East and the Crusades. The Renaissance. Reformation in England. Colonial England. France and the age of Louis XIV. Balance of power in Europe and the great struggle for colonial supremacy. Rise of Prussia and Russia. French Revolution. Napoleon and the Napoleonic Wars. Congress of Vienna. Empire of Germany. Russian Empire in the Nineteenth century. Near Eastern question. Triple Alliance. Entente. World War. Treaty of Peace of 1919. Conference for the Limitation of Armament.

NOTE: This subject (Ac-38) will be offered as soon as there is a reasonable demand for it.

STRUCTURAL DRAFTING (CE-16)—Definitions and general methods. Shop drawings. Plate girders. Roof trusses. Columns. Bridge trusses. Mill buildings. Checking and correcting drawings. Bills of materials. Shop bills. Shipping bills.

NOTE: (CE-24) is a prerequisite for (CE-16).

USE OF THE SLIDE RULE (CE-1)—Mechanical multiplication and division. Roots, powers. Theory of logarithms. Setting the rule to perform various arithmetical calculations. Locating the decimal point. How to perform a series of operations on the rule.

**Optional.* (*See Page* 12.)

"You may not be a genius, but an ordinary mind, fully developed, often enables its possessor to outstrip those with far greater natural advantages."

Special High School

(Ac-58x-Sp)

Students not finding the work they desire in the foregoing high school courses may enroll for this course. Select your own course from the following subjects. The information given below will enable you to make up a program that should satisfy all conditions in all the states of the Union as the equivalent in content of a four-year high school course, for which a diploma is granted.

English Grammar and Composition (Ac-3).
English Composition (Ac-4).
English Literature (Ac-5).
World's History to 1789 (Ac-29).
World's History, 1789 to 1920 (Ac-14).
World's History: American History (Ac-15).
Civics: American Government and Citizenship, (Ac-11), *or*
Civics: Government and Politics in the United States, (Ac-39).
Physical Geography (Ac-24).
General Science (Ac-25).
Biology (Ac-16).
Elementary Algebra (Ma-11).
Plane Geometry (Ma-14).

IN ADDITION, any FOUR of the following elective subjects are also required:

Intermediate Algebra (Ma-12).
Solid Geometry (Ma-15).
Advanced Algebra (Ma-13).
Plane Trigonometry (Ma-16).
Chemistry (Ac-42).
Physics (Ac-43).
Commercial Geography (Ac-10).
Ancient History (Ac-33).
Elementary French (ML-32).
Advanced French (ML-33).
Elementary Spanish (ML-31).
Advanced Spanish (ML-35).
Elementary German (ML-37).
Advanced German (ML-38).
Elementary Italian (ML-40).
Advanced Italian (ML-41).
First Year Latin (Ac-6).
Cæsar's Gallic Wars (Ac-7).
Cicero's Orations (Ac-8).
Virgil's Aeneid (Ac-9).
Business Arithmetic (Co-11).
Bookkeeping (Co-10).
Business Economics (Co-5).
Business Law (Co-1).
Shorthand:
Isaac Pitman (Co-19).
Graham (Co-18).
Gregg (Co-14).
Essentials of Drafting (Dr-45).
Freehand Drawing (Ar-13).

NOTE I—Chemistry and physics may be substituted for physical geography and general science.
NOTE II—Two subjects in advanced mathematics or one elementary foreign language may be substituted for two histories.
NOTE III—Each elementary foreign language covers two years' high school work and counts as two subjects.
NOTE IV—Those desiring to take more than sixteen subjects may have additional subjects at an extra cost. Price on application.
NOTE V—Those desiring to enroll for a single year's program made up from the subjects listed above should consult our salesman or write us direct.

Diplomas

The Extension Division of the United Y.M.C.A. Schools issues five diplomas based upon public school subjects, viz:

The GRAMMAR SCHOOL DIPLOMA having the content of the seventh and eighth grammar school grades.

The STANDARD DIPLOMA having the content of a four-year high school course.

The ECLECTIC DIPLOMAS having the content of two-, three-, or four-year high school courses.

It is especially recommended that those desiring a well-balanced education in English, mathematics, history, and science pursue the course of study leading to the STANDARD DIPLOMA, the equivalent of a four-year public high school course.

The ECLECTIC DIPLOMAS are intended for those who desire to elect subjects of special interest to themselves rather than for meeting special rules and regulations of state educational departments.

In general it may be stated that any four subjects form a high school curriculum for one year. At least one subject in English, one in science, one in history, and one in mathematics is advised for all eclectic diplomas.

Every elementary modern foreign language subject represents two years high school work and will be credited in the diploma as two of the four units required for a year's work.

Those desiring the diploma to conform to the legal requirements of the state in which they live should consult the state legal requirements for qualifying certificate or diploma, then select the subjects accordingly.

"I Will Study and Get Ready and Maybe My Chance Will Come."—Lincoln

Every high school diploma will be issued upon the completion of the required number of subjects and will represent in *content* the full equivalent of a high school curriculum for the number of years stated therein. The titles of the subjects in every case will be written into the diploma thus showing the exact work accomplished by the student to whom the diploma is issued.

Single Year High School Courses

We accept enrollments for a single year's high school work. Students desiring one year's high school work should enroll for one of these courses:

First Year

General High School (Ac-54xGe).
Commercial High School (Ac-54xCo).
Trade High School (Ac-54xTr).
Special High School (Ac-54xSp).

Second Year

General High School (Ac-55xGe).
Commercial High School (Ac-55xCo).
Trade High School (Ac-55xTr).
Special High School (Ac-55xSp).

Third Year

General High School (Ac-56xGe).
Commercial High School (Ac-56xCo).
Trade High School (Ac-56xTr).
Special High School (Ac-56xSp).

Fourth Year

General High School (Ac-57xGe).
Commercial High School (Ac-57xCo).
Trade High School (Ac-57xTr).
Special High School (Ac-57xSp).

In all our high school programs liberal adjustments in the selection of subjects are allowed to meet educational requirements of the various States.

English

You are favorably impressed by men and women who speak and write effectively. The way you express yourself advertises you favorably or acts against you. It is the outward sign by which people first judge your ability, and often your character. English is today most important. The American who cannot speak and write his own language correctly is handicapped. These courses offer you an easy, rapid way to become a fluent talker and a good writer.

English Grammar for Beginners

(Ac-3x)

This is an elementary course for the person who has not completed a grammar school education, especially if he did not go beyond the sixth grade.

Topics Covered in This Course:

ENGLISH GRAMMAR FOR BEGINNERS (Ac-1)—Pronunciation. Spelling. Parts of speech. Sentence elements. Capitalization. Punctuation. Paragraphing. Letter writing.

English Grammar and Composition

(Ac-8x)

An elementary course for those who have had English grammar for beginners, or who have a knowledge of English equivalent to 7th or 8th grade public school.

Topics Covered in This Course:

ENGLISH GRAMMAR AND COMPOSITION (Ac-3)—Word formation. Sentence correction. Grammar. Punctuation. Paragraphing. Letter writing. Four principal types of composition.

English Composition

(Ac-7x)

This course is intended for those who already have a good working knowledge of English composition and those who wish to perfect themselves in the understanding and use of English. After the completion of five or six lessons in this course it would be of value to the student to begin a study of English literature. The work in the one interestingly supplements the other.

Topics Covered in This Course:

ENGLISH COMPOSITION (Ac-4)—Diction, sentence mutation. Grammar. Letter writing. Narration. Description. Exposition. Argumentation. Figures of speech. Meter.

English Literature

(Ac-6x)

This course takes up the study of literature as taught in the best high schools and meets the requirements of state and college entrance examinations.

Topics Covered in This Course:

ENGLISH LITERATURE (Ac-5)—Criticism of works of standard authors. Composition. Reference books—History of English literature. Old Testament selections. Shakespeare, Scott, Dickens, Eliot, Carlyle. Other standard English authors.

English Grammar (Brief)

(Ac-9x)

This course is of high school grade. It is intended for those who have finished the 7th and 8th grades in public school and who desire a technical review of grammar.

Topics Covered in This Course:

ENGLISH GRAMMAR (Ac-2) — Parts of speech. Exhaustive sentence analysis. Declensions. Conjugations. Punctuation. Paragraphs. Dictionary drill. Pronunciation. Spelling.

Latin

Latin is an important subject of study because more than half of the words in the English language are derived from it. Also, it is the language in which some of the world's greatest literature was written. A knowledge of Latin gives the student a more complete understanding of English.

First Year Latin

(Ac-5x)

This subject, which comprises the Latin studied in the first year of high school, gives the student a knowledge of Latin grammar that will enable him to begin reading Latin literature. The subject also posseses a definite value for students who do not care to take more advanced work.

Topics Covered in This Course:

FIRST YEAR LATIN (Ac-6)—Nouns. Adjectives. Adverbs. Pronouns. Regular and irregular verbs. Rules of syntax. Exercises in word formation and derivation. Easy reading selections.

Caesar's Gallic Wars

(Ac-4x)

Julius Cæsar, the founder of the Roman Empire in fact though not in name, was one of the great figures of history. His fame rests both upon his generalship and his statesmanship. Cæsar has handed down to us a narrative that is full of interest for its description of the Gauls, of military operations, and of battles. This course gives the student the same instruction in Latin that is given in the course in Cæsar's Gallic Wars usually studied in the second year of high school.

Topics Covered in This Course:

CAESAR'S GALLIC WARS (Ac-7)—Translation—Four books of Cæsar's Gallic Wars. Review of grammar. Composition exercises. Exercises in word formation and derivation.

Cicero's Orations

(Ac-10x)

Cicero ranks as Rome's greatest orator and takes his place among the world's orators. The student today is impressed by the rich flow of language that swayed his hearers nearly 2000 years ago and he follows the arguments with keen interest. Equivalent of one year's study of Cicero in high school.

Topics Covered in This Course:

CICERO'S ORATIONS (Ac-8)—Translation—First Oration against Catiline. Second Oration against Catiline. Third Oration against Catiline. Manilian Law. Defense of Archias. Grammar and composition.

Virgil's Aeneid

(Ac-11x)

Among the few great masterpieces of epic art stands the Aeneid by Virgil. It has exerted a great influence on medieval and modern literature, where one finds many allusions to it. Throughout the study of this course, the student has the opportunity to enjoy a most fascinating and charming product of the imagination.

This course covers the same materials as one year's study of Virgil in high school.

Topics Covered in This Course:

VIRGIL'S AENEID (Ac-9) — Translation — Aeneid, books I, II, III, IV, VI. Grammar and composition. Versification. Content. Style. Appreciation.

Latin Composition

(Ac-38x)

This course is designed for students who wish to study Latin composition separately. It fulfills college entrance requirements.

Topics Covered in This Course:

LATIN COMPOSITION (Ac-30)—Complete study of syntax with written exercises based upon it.

Science

What a world of knowledge and interesting research is open to the man or woman who knows something of science! An understanding of even the elemental facts helps greatly in acquiring profitable knowledge along all lines. The manufacturer has his laboratories; so, often has the importer and retailer. The mining engineer must know much of science; so must the farmer. The average man can apply the simpler laws of science in caring for his health and in heating, lighting, and furnishing his home. There is scarcely a vocation in which one cannot use an understanding of science to advantage.

*General Science

(Ac-47x)

This course in General Science opens to the student some of the chief fields of scientific progress and illustrates their importance in daily life. It points out the direction in which progress may be made in the future. The course corresponds to first year work in science in the best high schools.

Topics Covered in This Course:

GENERAL SCIENCE (Ac-25) — Air, fire, water, food and their uses to mankind. The forces of nature. Homes and clothing. Work with everyday machines. Life—its origin and betterment.

**A box of apparatus and chemicals will be sent for performing the experiments.*

†Biology

(Ac-19x)

This course covers the work given in the best high schools and enables the student to become familiar with the laws of life and the relation of animal life to plant life.

Topics Covered in This Course:

BIOLOGY (Ac-16)—Composition of living and lifeless things. Foods, plants, animals, and the human body. Structures, adaptations, and functions of organs.

Botany

(Ac-20x)

This course deals with the description of plants and their relation to human welfare. The work is the equivalent of botany as studied in the best high schools and, if studied intensively, should prepare for all local examinations.

Topics Covered in This Course:

BOTANY (Ac-44) — Plants — structures and functions of organs. Forestry. Plant industries. Classification of plants.

Zoology

(Ac-31x)

This study of Zoology aims to present to the student a comprehensive view of the animal kingdom. It deals with the life phenomena and needs of the organism, adaptation to environment, methods of reproduction, and economic relation to mankind. This work is equivalent to the study of zoology in high schools and, if studied intensively, will prepare for local examinations.

Topics Covered in This Course:

ZOOLOGY (Ac-45)—Structure, habits and life history of insects, birds, frogs, fishes, crayfishes, Protozoa, Porifera, Coelenterata enterata, Annelida, Mollusca, Reptilia and Mammalia.

Physiology and Hygiene

(Ac-30x)

This course deals with the uses and functions of the human body; bacteria as friends and as foes to man; foods and their uses. The course comprises work done in the best high schools in the subject and, if studied intensively, should fully prepare the student for all examinations.

Topics Covered in This Course:

PHYSIOLOGY AND HYGIENE (Ac-46)—The continuity of life. The human mechanism; structure and functions of organs. Nutrition. Bacteria and disease. Personal, domestic and public hygiene. Sanitation.

*Chemistry

(Ac-53x)

This course presents the fundamental principles of chemistry and its applications in the life and education of the student. It is of high school grade or first year college grade, and is arranged to permit intensive study by the mature student.

Topics Covered in This Course:

CHEMISTRY (Ac-42)—The chemist and matter. Laws, theories, formulas, and equations. The elements and their compounds—their properties—physical and chemical.

*Physics

(Ac-52x)

This course aims to present the fundamental principles of physics and to describe applications of importance in the life and education of the student. Problems and exercises especially adapted to home study are assigned. Although the subject as presented is of high school grade our lessons are so arranged as to permit of more intensive study by mature students.

Topics Covered in This Course:

PHYSICS (Ac-43)—Weights and measures. Work. Mechanics of liquids and gases. Force and motion. Strength of materials. Energy. Heat. Electricity. Sound. Light.

Commercial Geography

(Ac-27x)

The course is of high school grade and will prove of value to every man engaged in business and to those who expect to enter the field where a knowledge of commercial geography is useful. It treats of the industrial conditions of the entire world.

Topics Covered in This Course:

COMMERCIAL GEOGRAPHY (Ac-10)—The United States and foreign countries. Climate and topography. Industries. Manufactures. Trade and trade routes. World commerce. Law of trade. Expansion of industry and resources. The world highway.

With the sixth lesson a year's subscription to the National Geographic Magazine is sent to the student.

Elementary Geography

(Ac-32x)

The course in Elementary Geography covers the whole range of geography as taught in the grades of our best schools. To those who wish to continue in the field of science, it serves as an introduction to general science and geology.

Topics Covered in This Course:

ELEMENTARY GEOGRAPHY (Ac-23)—The United States and foreign countries; their industries, commerce, and physical features. The earth; latitude and longitude. Winds. Rain. Ocean movements. Plants, animals, and peoples of the earth.

With the sixth lesson a year's subscription to the National Geographic Magazine is sent to the student.

Physical Geography

(Ac-28x)

This course is of high school grade and is written in simple terms. Technical terms are sparingly used and when used are defined by the text. The subject may well be an introduction to the study of science—especially to general and historical geology.

Topics Covered in This Course:

PHYSICAL GEOGRAPHY (Ac-24) — The earth, form, latitude, longitude, map construction, relief maps. The sun, solar system, earth's rotation, revolution, zones, time. Rivers, river valley cycles, systems. Weathering, surface wasting agents, soils. Glaciers. Plains, mountains, and plateaus. Volcanoes. Earthquakes. Atmosphere. Climate. Earth's magnetism. The ocean. Classification of coast line features. Distribution of life.

**Helpful experiments are included in the lessons. These experiments are optional. Students who desire may purchase a suitable laboratory outfit from us at cost. Price on application.*

† A box of apparatus and chemicals will be sent for performing the experiments.

General Geology

(Ac-24x)

An introductory course in geology involving the study of the composition of the earth, the forces and agencies which build it up and those that tear it down and the land forms resulting from these processes.

Topics Covered in This Course:

GENERAL GEOLOGY (Ac-21)—Subdivision of geology and methods of geologic study. Minerals. Rocks. Volcanic phenomena. Volcanoes. Rock destruction. Transportation, sorting and disposition of rock material. Consolidation of rock fragments. Rock deformation. Rock metamorphism. Earthquake and slower movements. Sculpture of the earth's surface. Elementary mapping.

Historical Geology

(Ac-25x)

A second course in geology in which is studied not only the history of the earth itself, but the history of the life upon it, from the beginning to man, and the history of the science.

Topics Covered in This Course:

HISTORICAL GEOLOGY (Ac-22)—Chronology of the rocks. Mapping and correlation of formations. Nature and preservation of fossils. Summary of the classes and characteristics of plants and animals. Origin of the earth. Pre-geologic stages of the earth. Pre-Palaeozoic. Detailed study of each Palaeozoic and Mesozoic period with a summary for each era. Detailed study of the organic evolution of man.

Economic Geology

Metallic

(Ac-22x)

This course deals with the principles of formation, metamorphism, and classification of metallic ores, and with methods of determining the position, value, and kind of ore bodies. The student should have a knowledge of general geology before studying this course. A knowledge of chemistry and physics will be helpful.

Topics Covered in This Course:

ECONOMIC GEOLOGY, METALLIC (Ac-19)—Formation of minerals. Flow, composition, chemical work, and origin of underground water and its relation to mineral deposits. Folding and faulting. Classification, form, structure, and texture of mineral deposits and ore shoots. Detrital deposits. Chemical concentrates. Evaporation residues. Residual deposits. Lake Superior hematite. Solution concentrates at depth. Regional metamorphism deposits. Native copper and lead and zinc near surface as sublimates from deep seated magmas. Thermal water deposits. Veins and intrusives. Contact metamorphism. Minerals of pegmatitic dikes. Magmatic concentrates. Oxidation and other metamorphism of ores. Metallogenetic epoch and review.

Economic Geology

Non-Metallic

(Ac-23x)

This course takes up the origin, mode of occurrence, value, methods of locating, methods of extracting, and methods of preparation for use of non-metallic substances. Special stress is laid on the economic geology of petroleum. The student should have some knowledge of general and historical geology before this course is studied.

Topics Covered in This Course:

ECONOMIC GEOLOGY, NON-METALLIC (Ac-20)—Coal. Petroleum. Gas. Building stones. Clay, Calcareous cements. Salines and associated substances. Gypsum. Fertilizers. Abrasives. Asbestos. Glass. Sands. Graphite. Non-metallic rare earths. Gems. Underground waters. Elementary mapping. Principles of formation and value of deposits.

History

By studying the events which have shaped the course of the world's history, we are better able to understand present-day conditions and to safeguard the future. The study of history enriches the mind of the student, broadens his outlook, and affords him a clearer insight into the problems of life. The person who knows history is much better prepared to succeed and to hold his own with other people than he who is ignorant of it. Those who have never had a chance to study a history course will welcome this opportunity.

Elementary History of the U. S.

Junior High School

(Ac-37x)

This course comprises something more than the work of the seventh and eighth grades in grammar school. Students who desire an elementary knowledge of the developments of this country from striving colonies to a world power should study this course.

Topics Covered in This Course:

ELEMENTARY HISTORY OF THE U. S. (Ac-41)—European beginnings in America. Coming of the English. Growth of colonies. War of the Revolution. Early republic. Rise of the Middle West. Civil War. National development. United States in the World War.

"The entire object of true education is to make people not merely do the right things, but enjoy them—not merely industrious, but to love industry—not merely learned, but to love knowledge—not merely pure, but to love purity—not merely just, but to hunger and thirst after justice."—John Ruskin

World's History to 1789

(Ac-43x)

Every man, woman, boy, and girl should have some knowledge of the whole past of mankind. Without it no one can have a real understanding of the world in which he lives, for the simple reason that the present can only be explained by the past. The conditions, institutions, and ideas of mankind in the early years of history are worth knowing, for upon these our present-day mode of living and rules of convention were founded.

This course is the equivalent of the history studied in the second year of high school.

Topics Covered in This Course:

WORLD'S HISTORY TO 1789 (Ac-29)—Early, middle, and late stone ages Egypt. Babylonia. Assyria. Chaldea. Medo-Persian Empire. Hebrews. Dawn of European civilization. Athens in the age of Pericles. Alexander the Great. Hellenistic age. Romans' conquests, world dominion and degeneracy, end of the republic, empire. German invasions. Rise of Papacy. Mohammedans. Charlemagne. Feudalism. England in the Middle Ages. Crusades. Medieval civilization. Protestant revolt and the wars of religion. Martin Luther. Seventeenth and Eighteenth centuries—struggle in England between King and Parliament, France under Louis XIV, Russia, Prussia.

World's History 1789 to 1920

(Ac-44x)

Great changes in conditions, ideas, and institutions have taken place in the past two centuries. It is important that every one should be thoroughly familiar with these changes. Monarchies, oligarchies, and empires have crumbled beneath the unconquerable tide of human opinion. Out of the chaos of revolution republics governed by the people and for the people have risen.

The underlying causes that have brought about this great transition are of the utmost interest and value to every one. History as taught in the third year of high school is thoroughly covered in this course.

Topics Covered in This Course:

WORLD'S HISTORY, 1789 TO 1920 (Ac-14)—Conditions and reforms in the Eighteenth century. French revolution and Napoleon. Reconstruction of Europe at the Congress of Vienna. Revolution of 1848 in France, Austria, Germany, Italy. Formations of Italy, German Empire, Austria-Hungary. Reforms in Europe Before the World War. Expansion of Europe. Spread of western civilization. British Empire, Russian Empire, Turkey and the Eastern question. European interests in the Far East. Opening years of the Twentieth century. The World War. The Russian Revolution. Reconstruction of Europe. Europe after the World War.

World's History: American History

(Ac-45x)

Social and economic aspects of our history, the causes and results of wars, and the unique characteristics that have played an important role in shaping the destinies of our country should be known by every man and woman who wants to become an American citizen.

This course, which goes deeply into every phase of American history, is equivalent to that studied in the fourth year of high school.

Topics Covered in This Course:

WORLD'S HISTORY: AMERICAN HISTORY (Ac-15)—Discovery and exploration. Colonization. Colonial history. Independence, 1775-1783. The Constitution, 1783-1789. Federalist supremacy, 1789-1800. Jeffersonian republicans, 1801-1812. War and peace, 1812-1829. National democracy, 1829-1844. Slavery in the territories. Secession. Civil War. Reconstruction. National development. United States in our own times. The great war.

Ancient History

(Ac-35x)

A knowledge of the political and industrial history of the ancient nations of the world is of the utmost value to every man and woman of culture. Also, the student wishing to gain an extra point in history can prepare himself by studying this course. It is equivalent to one year of history in high school.

Topics Covered in This Course:

ANCIENT HISTORY (Ac-33)—Egypt. Tigris-Euphrates states. Phoenicians. Hebrews, Persian Empire. Greeks—Prehistoric Hellas, Cretan civilization, Homeric Age, Persian wars, Athenian leadership, age of Pericles, fall of Athens. Alexander and his conquests. Mingling of the East and West. Rome—land and peoples, legendary history, unification of Italy, government of the republic, conquests, Pompey and Cæsar, the empire. Rise of Christianity. Teutons. Wanderings of the peoples. Dark Ages. Western Europe. Empire of Charlemagne.

Modern History

(Ac-42x)

The conditions, institutions, and ideas of the old world out of which have been molded our present-day life furnish a very interesting and educative part of history. Every man or woman who takes this course will gain increased breadth of vision. Modern History as taught in one year of high school is covered thoroughly in this course.

Topics Covered in This Course:

MODERN HISTORY (Ac-38)—Brief review of ancient history. Transition period from ancient to modern history. East and the Crusades. The Renaissance. Reformation in England. Colonial England. France and the age of Louis XIV. Balance of power in Europe and the great struggle for colonial supremacy. Rise of Prussia and Russia. French Revolution. Napoleon and the Napoleonic Wars. Congress of Vienna. Empire of Germany. Russian Empire in the Nineteenth century. Near Eastern question. Triple Alliance. Entente. World War. Treaty of Peace of 1919. Conference for the Limitation of Armament.

English History

(Ac-41x)

This course is equivalent to one year's study of English History in high school. It can be studied to advantage by the student to further his academic education and by all men and women who wish to increase their intellectual powers.

Topics Covered in This Course:

ENGLISH HISTORY (Ac-36)—Early Britain to 449 A. D. Saxon England, 449-1066. Norman England, 1066-1154. England under the Plantagenets, 1154-1435. Tudor England, 1485-1603. Puritan Revolution and Royalist reaction, 1603-1688. Constitutional monarchy, 1688-1820. British Empire, 1820-1921. Anglo-American relations. Irish question. England in the World War.

Government

Wouldn't you like to know more about the government of our country and her states and cities? Wouldn't you like to understand the Constitution and the limitations it puts upon the President, Congress, and the states? Do you know about the functions of Congress, the duties of the President, the authority of the Supreme Court? How can you understand the conflicting opinions in the newspapers, the arguments in Congress, and hold your own in discussions of proposed laws and public questions unless you know the facts concerning the workings of the government of our nation, states, and cities? Every American should know the important facts relating to the government he has sworn to support. These courses make home study easy and interesting.

Civics: American Government and Citizenship

(Ac-2x)

This is an elementary course for those wishing to have a general knowledge of American government. It is of especial value to aliens who desire to become citizens.

Topics Covered in This Course:

CIVICS: AMERICAN GOVERNMENT AND CITIZENSHIP (Ac-11)—Human needs and the government. Nature of modern government. Civil liberty. Property rights. Political liberty. National, state, municipal and rural government. Elements of community welfare. Financial, economic, industrial and social problems.

Civics: Government and Politics in the United States

(Ac-33x)

This course, which is equal in content to the work done in the best high schools during the fourth year or that done in the first year of college, is especially designed for the advanced student who desires a technical and theoretical knowledge of civics.

Topics Covered in This Course:

CIVICS: GOVERNMENT AND POLITICS IN THE UNITED STATES (Ac-39)—Local governments. State governments. The national government. Powers of Congress. Federal judiciary. Constitutional protection of business and personal rights. The party. Public opinion. Civil service. Direct legislation.

Pedagogy

In order to be a successful teacher one must not only understand well what he teaches but also know the best methods of teaching. A study of the mental processes of the student and of teaching methods developed and used by other educators is very helpful. The following courses present this knowledge in a thorough attractive way.

History of Education

(Ac-13x)

This course is designed for teachers who wish to complete a study of the subject in a short time. The student is given a clear understanding and appreciation of present day educational problems by acquainting him with conditions and ideals of the past which have produced these problems.

Topics Covered in This Course:

HISTORY OF EDUCATION (Ac-32)—Primitive, Oriental, Greek and Roman Education. Education of the Middle Ages, Renaissance, Reformation, Disciplinary, Naturalistic, Psychological, Scientific and Sociological Conceptions of Education. Modern tendencies. Educational theories and experiments worked out by pioneers. Rise, growth and comparison of the national systems of education in England, France, Germany, Italy, and the United States.

Educational Psychology

(Ac-15x)

This course discusses the bases of child behavior and the relation of behavior to the modern educational principles which have been evolved for its control.

Topics Covered in This Course:

EDUCATIONAL PSYCHOLOGY (Ac-34)—The instinctive behavior of children is explained in a study of the following instincts: migratory, food getting, ownership, gregarious play, fighting, display, approval, curiosity, imitation. Effect of child behavior on the four principal emotions. Three great laws of heredity. Special studies of heredity and the inheritance of acquired characteristics. Environment. Habit. Sensation. Perception. Attention. Memory. Imagination. Thinking. Will. Moral development. Individual differences.

Note: With the fifth lesson in either (but not both) History of Education or Educational Psychology, a year's subscription to the Teachers College Record is sent to the student.

P. J. Garrey, Supt. of Schools, Allen, Mich.

My correspondence work with the Y.M.C.A. has given me a very pleasant surprise. I find a person makes just as much progress, if the course is conscientiously pursued, as if he were daily attending lectures in some well-known college.

LANGUAGES



M. C. ELSESSER

WITH the use of the trans-oceanic cable, the aeroplane, wireless telegraphy, and the radiophone, the nations of the world have been brought into a very close social, political, and commercial relationship. Men and women who seek positions with importers or exporters, with manufacturers who sell in foreign lands, or with banks who maintain foreign connections, are being asked "Can you speak, read, and write French?" or, as the case may be, German, Italian, or Spanish.

But to many people the cultural advantage of knowing a foreign language appeals more strongly than knowing it as a business asset. Think of the pleasure in being able to read the original works of noted old-time and modern writers of other countries, and of the satisfaction in recognizing instantly the foreign words and phrases found in American books and magazines. To understand and converse with well-educated, traveled foreigners is even more delightful. Among people of culture and learning one is considered as lacking essential education if he cannot write and talk in languages other than English.

Our Better Way of Teaching

To learn a foreign language you need not employ a high-priced teacher or go to college. You can learn at home easily and rapidly by our modern home-study methods in which the phonograph is employed to teach correct pronunciation. This interesting method makes learning a pleasure instead of a task. Each phonograph record speaks as your personal instructor, for five minutes or five hours, any time you desire. This patient instructor repeats, as often as you like, all words and phrases until you become letter perfect. You hear the exact reproduction of the native professor's voice. You listen to his inflection and accent until you also can speak correctly. You study from the best textbooks, supplemented by instruction sheets that make it easy to understand the grammar and composition of the language.

Your written lessons are examined by professors and instructors trained in teaching languages by the correspondence method. They correct faulty grammar, misspelled words, and incorrect punctuation, and give you all the personal aid you require.

High Grade Instruction

M. C. Elsesser, M.A., head of the Department of Modern Languages, has had fifteen years' experience as a teacher of languages. After graduating from the French Lycee of Belfort and the University of Berne, he was for some time professor at the University of Paris. On coming to this country he became professor of languages at Brown School of Tutoring, and later professor of languages at Columbia University. Among the able instructors assisting Mr. Elsesser is Nemesio G. Mantero, M.A., a graduate of the University of Madrid, and for some time professor at the La Gran Antilla College, Havana, Cuba.



NEMESIO G. MANTERO

French

With a knowledge of French and English you can travel the world. From the standpoint of cultural value a knowledge of French will help to broaden one's intellect immensely. As an asset in business, French is also of great importance. Over fifty million people living in France, Belgium, Switzerland, Morocco, French Guiana, and Martinique provide an attractive market for many American products.

Elementary French

With Records (ML-31x)

This course teaches the fundamentals of grammar, conversation, and reading, giving the student a fair working knowledge of French. Through the medium of the records the student learns the correct pronunciation from a French professor. This course is equivalent to two years' study of French in high school.

Topics Covered in This Course:

ELEMENTARY FRENCH, with Records (ML-32)—French Grammar. Parts of speech. Use of various tenses. General rules for construction of French sentences. Conversational lessons. Reading lessons—Histoire de France. La Poudre aux Yeux.

Elementary French

No Records (ML-27x)

This course is of special benefit to students. Those also who wish to read various French literary works in their original form should study this course, which is equivalent to two years' study of French in high school.

Topics Covered in This Course:

ELEMENTARY FRENCH, no Records (ML-23) —French Grammar. Parts of speech. Use of various tenses. General rules for construction of French sentences. Conversational lessons. Reading lessons—Histoire de France. La Poudre aux Yeux.

Advanced French Academic

With Records (ML-32x)

The object of this course, which covers the grammar, reading, and composition required in the third year of high school, is to give the academic student a complete knowledge of French with the aid of phonographic records. A knowledge of Elementary French is a prerequisite to this course.

Topics Covered in This Course:

ADVANCED FRENCH, ACADEMIC, with Records (ML-33)—French prose composition. Drill of French idioms. Study of the principal French authors. Translation of English into French. Phonograph Records—Stories in French by Alfred de Vigny, La Fontaine, Bossuet, Pierre Loti, Victor Hugo, Molière, Chateaubriand, Gautier, A. Chenier. Reading lessons—"Les Trois Mousquetaires," Dumas "Monte Cristo," Dumas.

Advanced French Commercial

No Records (ML-33x)

The business man or woman desiring to learn French so that it will be a business asset will get just the right instruction from this course. The phraseology of business transactions, and other affairs of importance in French business are taught in the most modern way.

Topics Covered in This Course:

ADVANCED FRENCH, COMMERCIAL, No Records (ML-34)—Business essentials which serve as the groundwork of trade. Commercial correspondence. Recognized commercial modes of expression. Banking operations. Making out of shipping documents and invoices. Commission business. Transportation.

Complete French Academic

With Records (ML-34x)

This course, commencing with elementary grammar, conversation, and reading, takes the student, step by step, through every phase of the French language. With the valuable aid of phonographic records the student is drilled in correct pronunciation. This course is equal in content of grammar, composition, and reading to that covered in three years of high school.

Subjects Covered in This Course:

ELEMENTARY FRENCH, with Records, (ML-32)—Grammar. Translation exercises. Conversational lessons. Reading lessons—Histoire de France. La Poudre aux Yeux. These lessons will be of practical value to the student intending to travel in Europe.

ADVANCED FRENCH, with Records (ML-33) —French prose composition. Drill of French idioms. Study of the principal French authors. Translation of English into French. Phonograph Records.—Stories in French by Alfred de Vigny, La Fontaine, Bossuet, Pierre Loti, Victor Hugo, Molière, Chateaubriand, Gautier, A. Chenier. Reading lessons—Six hundred pages of French literature is the minimum amount of reading required: "Les Trois Mousquetaires," Dumas. "Monte Cristo," Dumas.

Complete French Commercial

With Records (ML-53x)

With the help of phonographic records, the student is made perfect in Commercial French. On completion of the course he should be able to read, talk, and write French like a native, and do business with the Frenchman on the common ground of perfect understanding.

Subjects Covered in This Course:

ELEMENTARY FRENCH, with Records (ML-32)—Grammar. Translation exercises. Conversational lessons. Reading lessons—Histoire de France. La Poudre aux Yeux.

ADVANCED FRENCH, COMMERCIAL, No Records (ML-34)—Business essentials which serve as the groundwork of trade. Commercial correspondence. Recognized commercial modes of expression. Banking operations. Making out of shipping documents and invoices. Commission business. Transportation.

Spanish

A hidden world of wonderful literature and art is open to the man or woman with a knowledge of Spanish. The courageous exploits of its ancient voyageurs, whose activities spread the web of civilization to the furthermost corners of the earth, have been transformed into delightful, interesting stories by the virile pen of imaginative Spanish writers. In business also, a man or woman with a knowledge of Spanish has many opportunities for advancement.

Elementary Spanish

With Records (ML-35x)

Men and women desiring to begin the study of Spanish and acquire such understanding as will enable them to talk with Spanish-speaking people and transact every-day business with them, should study this course. Pronunciation is made perfect by practice. It is equivalent to two years of Spanish as studied in high school.

Topics Covered in This Course:

ELEMENTARY SPANISH, with Records (ML-31)—Grammar. General rules for construction of Spanish sentences. Conversational lessons. Reading lessons—"Amalia," "Amparo."

Elementary Spanish

No Records (ML-28x)

This course will meet the needs of the student who feels competent to gain a knowledge of Elementary Spanish without the use of phonographic records. During the course of study, the reading of two hundred pages of Spanish literature is required. It is equivalent to two years of Spanish as studied in high school.

Topics Covered in This Course:

ELEMENTARY SPANISH, no Records (ML-24)—Grammar. General rules for construction of Spanish sentences. Conversational lessons. Reading lessons—"Amalia," "Amparo."

Advanced Spanish Academic

No Records (ML-36x)

The object of this course, which covers the grammar, reading, and composition required in the third year of high school, is to give the academic student, with the aid of phonographic records, a complete knowledge of Spanish.

A knowledge of Elementary Spanish is a prerequisite to this course.

Topics Covered in This Course:

ADVANCED SPANISH, ACADEMIC, no Records, (ML-35)—Spanish prose composition. Drill in Spanish idioms. Study of the principal Spanish authors. Translation of English into Spanish. Reading lessons—"La Navidad en las Montañas." "Don Quijote," Cervantes.

Advanced Spanish Commercial

With Records (ML-37x)

This course will be of great value to the man or woman with a fair knowledge of Spanish who wish to become proficient in this language as employed in the business field. With the assistance of the phonograph records that accompany this course, the student can, in a short time, acquire a perfect pronunciation.

Topics Covered in This Course:

ADVANCED SPANISH, COMMERCIAL, with Records, (ML-36)—Business essentials which serve as the groundwork of trade. Commercial correspondence. Recognized commercial modes of expression. Banking operations. Making out of shipping documents and invoices. Commission business. Transportation.

Complete Spanish Academic

With Records (ML-38x)

This course is for the student who desires a complete knowledge of Castilian Spanish. With the phonograph records as his instructor, the student can in a short time talk Spanish with a native accent. The content of this course is equivalent to three years of high school work in Spanish.

Subjects Covered in This Course:

ELEMENTARY SPANISH, with Records (ML-31) — Grammar. Translation exercises. Conversational lessons. Reading lessons—"Amalia," "Amparo."

ADVANCED SPANISH, ACADEMIC, no Records, (ML-35)—Spanish prose composition. Drill in Spanish idioms. Study of the principal Spanish authors. Translation of English into Spanish. Reading lessons. Six hundred pages of Spanish literature is the minimum required amount of reading: "La Navidad en las Montañas." "Don Quijote," Cervantes.

Complete Spanish Commercial

With Records (ML-54x)

The man who desires to make foreign trade his life's work should study this course. Thorough instruction, combined with the use of phonograph records, insures to the student the intelligent understanding and fluent use of Spanish that will help him up the road to quick advancement.

Subjects Covered in This Course:

ELEMENTARY SPANISH, with Records, (ML-31)—Grammar. Translation exercises. Conversational lessons. Reading lessons—"Amalia," "Amparo."

ADVANCED SPANISH, COMMERCIAL, with Records, (ML-36)—Business essentials which serve as the groundwork of trade. Commercial correspondence. Recognized commercial modes of expression. Banking operations. Making out of shipping documents and invoices. Commission business. Transportation.

German

The analytical brain of the Teuton is reflected clearly in the German language. To students of the many sciences, as surgery, chemistry, and other allied professions, a knowledge of German is essential. They should be able to read in the original the many important works on science that have come from the pens of the great German scholars and scientists.

Elementary German

With Records (ML-39x)

With the helpful aid of phonograph records, each an exact reproduction of the voice of a native professor, the student on completing this course is familiar with the grammar, composition, and correct pronunciation of German. This course, which is equivalent to two years' study in high school, is for those who desire only a working knowledge of the language.

Topics Covered in This Course:

ELEMENTARY GERMAN, with Records, (ML-37)—Grammar. General rules for construction of German sentences. Conversational lessons. Reading lessons—Bernhardt's "Kleine Geschichten." Storm's "Immensee."

Elementary German

No Records (ML-29x)

Men and women desirous of the knowledge of German that will enable them to read scientific and other German works in their original should study this course. Students who desire training in German grammar, composition, and reading that will help them to further their academic education will receive valuable assistance from the study of this course. It is equivalent to two years' study in high school.

Topics Covered in This Course:

ELEMENTARY GERMAN, no Records, (ML-25)—Grammar. General rules for construction of German sentences. Conversational lessons. Reading lessons—Bernhardt's "Kleine Geschichten." Storm's "Immensee."

Advanced German Academic

With Records (ML-40x)

Academic students who possess a slight knowledge of German and desire to further their education will find a study of this course of distinct value. A knowledge of Elementary German is a prerequisite to this course.

Topics Covered in This Course:

ADVANCED GERMAN, ACADEMIC, with Records, (ML-38)—German prose composition. Drill of German idioms. Study of the principal German authors. Translation into German. Phonograph Records. Stories in German by Goethe, Heine, Schiller, N. Lenau, F. Luckert, Uhland. Reading lessons—Goethe, "Das Märchen." Schiller, "Der Geisterscher."

Advanced German Commercial

No Records (ML-41x)

In this course the student is trained in modern business methods connected with German trade. He is taught to think and to write in German business terms until he becomes proficient in their use.

Topics Covered in This Course:

ADVANCED GERMAN, COMMERCIAL, no Records, (ML-39)—Business essentials which serve as the groundwork of trade. Commercial correspondence. Recognized commercial modes of expression. Banking operations. Making out of shipping documents and invoices. Commission business. Transportation.

Complete German Academic

With Records (ML-42x)

Students of the sciences and scholars will find a valuable aid to the furtherance of their education in the study of this course. It is equivalent in content to three years' study in high school. Upon completion of the course the student should be able to read, write and speak German correctly.

Subjects Covered in This Course:

ELEMENTARY GERMAN, with Records, (ML-37)—Grammar. Translation exercises. Conversational lessons. Reading lessons—"Kleine Geschichten," Storm's "Immensee."

ADVANCED GERMAN, ACADEMIC, with Records, (ML-38)—German prose composition. Drill of German idioms. Study of the principal German authors. Translation into German. Phonograph Records. Stories in German by Goethe, Heine, Schiller, N. Lenau, F. Luckert, Uhland. Reading lessons—Six hundred pages of German literature is the minimum amount of reading required: Goethe, "Das Märchen." Schiller, "Der Geisterscher."

Complete German Commercial

With Records (ML-55x)

This course is especially for the business man or woman who is doing business with German concerns, and those who at some future time intend to trade with the Teutons. Every phase of commerce is covered in detail. The student is trained to correspond in German, also to conduct commercial negotiations with German concerns.

Subjects Covered in This Course:

ELEMENTARY GERMAN, with Records, (ML-37)—Grammar. Translation exercises. Conversational lessons. Reading lessons—"Kleine Geschichten," Storm's "Immensee."

ADVANCED GERMAN, COMMERCIAL, no Records, (ML-39)—Business essentials which serve as the groundwork of trade. Commercial correspondence. Recognized commercial modes of expression. Banking operations. Making out of shipping documents and invoices. Commission business. Transportation.

Italian

Italy is the home of art. From its bosom was reared a galaxy of painters that today rank as the greatest. Also from its shores have come many of the greatest operatic stars, who have charmed the world with their golden voices. More than two thousand Americans are studying art and voice in Rome. This huge number of students is sufficient proof of the value of a knowledge of Italian in the realms of culture. Also as a help in business, Italian is of distinct value.

Elementary Italian

With Records (ML-43x)

In this course, which is equivalent to two years' work in high school, the student is given valuable instruction in Italian. Phonograph records that are exact reproductions of a native professor's voice assist the student in acquiring a perfect accent.

Topics Covered in This Course:

ELEMENTARY ITALIAN, with Records, (ML-40)—Italian Grammar. General rules for construction of sentences. Conversational lessons. Reading lessons—"Due Commedie Moderne." Goldoni's "Il Vero Amico."

Elementary Italian

No Records (ML-30x)

Students who desire to make up lost ground in their language studies, or to further their academic education, should study this course, which is equivalent to two years' high school work in Italian.

Topics Covered in This Course:

ELEMENTARY ITALIAN, no Records, (ML-26)—Italian Grammar. General rules for construction of sentences. Conversational lessons. Reading lessons—"Due Commedie Moderne." Goldoni's "Il Vero Amico."

Advanced Italian Academic

With Records (ML-44x)

Men and women who have an elementary knowledge of Italian should take up the study of Advanced Italian. This course covers all the grammar, reading, and composition required in the third year of high school. Phonograph records assist the student in making him perfect in his pronunciation. A knowledge of Elementary Italian is a prerequisite to this course.

Topics Covered in This Course:

ADVANCED ITALIAN, ACADEMIC, with Records, (ML-41)—Italian prose composition. Drill of Italian idioms. Study of the principal Italian authors. Translation of English into Italian. Phonograph Records. Stories in Italian by Dante, Petrarca, Alfieri, Leopardi, Manzoni, De Amicis. Reading lessons—Dante's "Divina Commedia, Inferno" and "Divina Commedia, Paradiso."

Advanced Italian Commercial

No Records (ML-45x)

This course goes into every detail of grammar, composition, and reading, giving the student a thorough working knowledge of the subject. He is taught to think and to write in Italian business terms until he becomes proficient in their use.

Topics Covered in This Course:

ADVANCED ITALIAN, COMMERCIAL, no Records, (ML-42)—Business essentials which serve as the groundwork of trade. Commercial correspondence. Recognized commercial modes of expression. Banking operations. Making out of shipping documents and invoices. Commission business. Transportation.

Complete Italian Academic

With Records (ML-46x)

This course is equivalent in content to three years' study in high school. The manner of teaching grammar, conversation, and reading, combined with the use of phonograph records in conversational work, makes the course of value to the student anxious to further his academic education by a study of Italian.

Subjects Covered in This Course:

ELEMENTARY ITALIAN, with Records, (ML-40)—Grammar. Translation exercises. Conversational lessons. Reading lessons—"Due Commedie Moderne." Goldoni's "Il Vero Amico."

ADVANCED ITALIAN, ACADEMIC, with Records, (ML-41)—Italian prose composition. Drill of Italian idioms. Study of the principal Italian authors. Translation of English into Italian. Phonograph Records. Stories in Italian by Dante, Petrarca, Alfieri, Leopardi, Manzoni, De Amicis. Reading lessons. Six hundred pages of Italian literature is the minimum amount of reading required: Dante's "Divina Commedia, Inferno" and "Divina Commedia, Paradiso."

Complete Italian Commercial

With Records (ML-56x)

This course goes thoroughly into every phase of the subject, giving the student a well rounded working knowledge of the language.

Subjects Covered in This Course:

ELEMENTARY ITALIAN, with Records, (ML-40)—Grammar. Translation exercises. Conversational lessons. Reading lessons—"Due Commedie Moderne." Goldoni's "Il Vero Amico."

ADVANCED ITALIAN, COMMERCIAL, no Records, (ML-42)—Business essentials which serve as the groundwork of trade. Commercial correspondence. Recognized commercial modes of expression. Banking operations. Making out of shipping documents and invoices. Commission business. Transportation.

English for Foreign Speaking People

The foreigner in America cannot get along well until he learns English. He must know what Americans mean when they speak to him. He must speak English so he can express well what he thinks. He must read and write English so he can understand contracts and other legal papers, and learn about laws and taxes. If he knows English he advances faster as a workman, or can get into business sooner. If he tries to know English by the slow method of learning from people he meets, he learns faulty speech.

These "Y" courses offer the simple instruction he needs. By listening to phonograph records he learns to speak correctly and use words accurately. Besides this drill in correct speech, he is taught to read readily and write clearly. The lessons he writes are interesting—they deal with every-day affairs and with conversation as commonly used in daily life. He learns rapidly.

English—French

With Records (ML-47x)

Those who speak French should study the English course (ML-47x) for French-speaking people.

Ceux qui parlent le français devraient suivre le cours d'anglais (ML-47x) pour les gens de langue francaise.

Subjects Covered in This Course:

ELEMENTARY ENGLISH—FRENCH, with Records (ML-43)—Regular and irregular verbs. Gender. Case. General rules for the construction of English sentences. Home. School. Church. Shop. Office. Store. Restaurant. Theatre. Hotel.

ADVANCED ENGLISH FOR NEW AMERICANS, no Records (ML-54)—Letter writing. American customs. Geography. American History. Citizenship.

English—Spanish

With Records (ML-48x)

Those who speak Spanish should study the English course (ML-48x) for Spanish-speaking people.

Los que hablan español deben estudiar el curso de ingles (ML-48x) para españoles.

Subjects Covered in This Course:

ELEMENTARY ENGLISH—SPANISH, with Records (ML-45)—Regular and irregular verbs. Gender. Case. Differences in the construction of English and Spanish sentences. Home. School. Church. Shop. Office. Store. Restaurant. Theatre. Hotel.

ADVANCED ENGLISH FOR NEW AMERICANS, no Records (ML-54)—Letter writing. American customs. Geography. American History. Citizenship.

English—Italian

With Records (ML-50x)

Those who speak Italian should study the English course (ML-50x) for Italian-speaking people.

Coloro che parlano Italiano dovrebbero iscriversi al corso d'Inglese (ML-50x) positamente per i soli Italiani.

Subjects Covered in This Course:

ELEMENTARY ENGLISH—ITALIAN, with Records (ML-52)—Parts of speech. Grammar. General rules for the construction of English sentences. Home. School. Church. Office. Shop. Store. Restaurant. Theatre. Hotel.

ADVANCED ENGLISH FOR NEW AMERICANS, no Records (ML-54)—Letter writing. American customs. Geography. American History. Citizenship.

English—German

With Records (ML-49x)

Those who speak German should study the English course (ML-49x) for German-speaking people.

Diejenigen, welche Deutsch sprechen, sollten den englischen Kursus (ML-49x) für Deutschsprechende Leute studieren.

Subjects Covered in This Course:

ELEMENTARY ENGLISH—GERMAN, with Records (ML-47)—Parts of speech. Grammar. General rules for the construction of English sentences. Home. School. Church. Shop. Office. Store. Restaurant. Theatre. Hotel.

ADVANCED ENGLISH FOR NEW AMERICANS, no Records (ML-54)—Letter writing. American customs. Geography. American History. Citizenship.

English—Portuguese

With Records (ML-51x)

Those who speak Portuguese should study the English course (ML-51x) for Portuguese-speaking people.

Aquelles que fallam Portuguez devem estudar o curso Inglez (ML-51x) para pessoas de lingua Portugueza.

Subjects Covered in This Course:

ELEMENTARY ENGLISH—PORTUGUESE, with Records (ML-55)—Regular and irregular verbs. Gender. Case. General rules for the construction of English sentences. Home. School. Church. Shop. Office. Store. Restaurant. Theatre. Hotel.

ADVANCED ENGLISH FOR NEW AMERICANS, no Records (ML-54)—Letter writing. American customs. Geography. American History. Citizenship.

English for New Americans

With Records (ML-52x)

This course is especially adapted to the needs of foreign-speaking people who have a slight knowledge of the English language. The student is thoroughly trained in how to read, write, and speak English correctly.

Topics Covered in This Course:

ELEMENTARY ENGLISH FOR NEW AMERICANS, with Records (ML-53)—Parts of speech. Grammar. General rules for the construction of English sentences. Home. School. Church. Shop. Office. Store. Restaurant. Theatre. Hotel. Trading.

ADVANCED ENGLISH FOR NEW AMERICANS, no Records (ML-54)—Letter writing. American customs. Geography. American History. Citizenship.



Public Speaking

(LT-2x)

ARE you one of the thousands of young men who are seeking a way to overcome fear and timidity before an audience and to acquire public speaking ability? Fear of an audience can be easily overcome and once conquered is destroyed forever. Self-confidence is POWER. The ability to stand before an audience, large or small, and express your thoughts in a positive, forceful, convincing manner, is one of the most important factors in achieving success in your life's work. Self-confidence, knowledge of your subject, and power of expression make progress in modern business more rapid. The man who possesses and uses them has a great advantage over the one who cannot speak to groups of people readily and well.

Every One Needs This Ability

One may be called on at church, lodge, or club meetings to take part in discussions, or to entertain friends with stories or an account of a trip. He may be asked to present a report of an investigation to a committee, or to speak or preside at a dinner. The speaker who finds the largest use for this art is the one who can clearly, earnestly, and convincingly advance some cause, or talk well at business meetings. This is a very practical course; one that has been thoroughly tried out. It shows the student how to build up all the qualities required in public speaking; how to arrange thoughts logically; and how to present them effectively.

Topics Covered in This Course:

PUBLIC SPEAKING (LT-5)—Value of ability to speak in public. The path to power. Public speaking in business an aid to success. Speaking in the professions. Speaking in social life. Acquiring self-confidence. Ways to develop will and conquer fear of appearing in public. Building personality.

Vital Speech—Value of positive language. Choosing live topics. Ways that convince. Acquiring earnestness. Building voice power. Developing enthusiasm. Secret of power.

Memorizing—Memorizing by associating ideas. Illustration as aids to memory. Methods of memorizing speeches. Memorizing by use of pictures. Simple laws—association, repetition, impression. Developing memory by will power and through the senses.

Opening and Closing the Address—Getting favorable attention. How to begin a speech. Exercising self-control. Establishing agreeable contact with audience. Positive opening appeal. Use and misuse of emphasis. Methods of closing a speech. The climax.

Preparation for the Speech—Necessity for preparation. Analyzing the speech. Example of speech and analysis. Methods of well-known speakers. Knowing your subject. Filing information and ideas. Developing power of analysis. Charting talk. Speaking practice. Developing voice.

Arranging the Speech—Four purposes of an address. Making it clear, convincing and influencing. Grouping ideas effectively. Logical arrangement of facts according to listener's point of view. Presenting ideas according to time, place, or cause. Developing clearness.

The Convincing Speech—Human interest appeal. Use of concrete illustrations. Word pictures. Arguing from analogy. Graphic argument with figures and numbers. How to appeal to reason, to feelings, to senses. How to quote authorities.

The Well Delivered Speech—"It's not so much what you say as how you say it." Essentials of good delivery. Accenting right words to gain force. Practical drills. Ways to develop expression. Tone color in the voice and how to improve it. How to speak with earnestness, freedom and feeling.

The Attractive Speech—How to gain and hold interest. Setting the stage. Gestures—when and how to make them. Certain gestures and their meaning. Creating a good impression through attractive appearance and self-control. Avoiding distracting movements. Standing and walking correctly. How to develop facial expressions.

The Distinctive Speech—Choosing right words and using them effectively. How Woodrow Wilson learned to marshal words. Building your vocabulary. Phrases to avoid. Force in proper synonyms. Examples of right and wrong uses of words. How to study words. Value of figurative language. How to use similes.

The Decisive Speech—Salesmanship in public speaking. Influencing others to act. Getting attention. Securing confidence of hearers. Educating them about the merits of your proposal. Motives that influence action. How to answer objections.

The Audience—Arrangement of audience. Hints on crowd psychology. The value of music in a public meeting. Importance to the speaker of proper lighting and ventilation.

Acquiring Leadership—Audience influenced by confident manner and tone. Win prestige to impress hearers. Value of being well introduced. Art of leadership.

Speech Building—Drills in enunciation. Exercises in pronunciation. Errors to avoid in speaking. Overcoming errors in English. Breathing correctly. Vocal exercises. Voice training. Tongue exercises.

Leadership Training

The demand for technically trained leaders for organizations, institutions and communities is rapidly increasing, and as the spirit of democracy grows, opportunities for attaining positions of leadership will multiply. The responsibility for leadership ultimately falls upon the shoulders of the trained man. The unskilled, the uninformed, will give place to those who know.

It is the purpose of this department to serve those now in positions of leadership by making available to them directed studies creative of leadership prepared by eminent specialists, and to prepare a curricula of studies for those desiring to train for particular fields of service.

Community Organization and Leadership

(LT-9x)

This is a one-subject course to aid those interested in community service and other similar activities. It is of especial value to Y.M.C.A. secretaries, ministers, school teachers, social workers and club leaders. The fundamental principles and conditions of community life are dealt with in a thorough, comprehensive manner.

Topics Covered in This Course:

COMMUNITY ORGANIZATION AND LEADERSHIP (LT-1)—Social nature of man. Neighborhood. The community. Community institutions and their functions. Vital interest groups. Types of communities. Community movement and democracy. Community needs and agencies. Institutionalism and the division of labor. Process of community action. Community organization. Christianity and community leadership.

Leadership Training in the Christian Citizenship Training Program

PIONEERS, Boys 12-14 years (LT-8x) COMRADES, Boys 15-17 years (LT-7x)

Leaders of groups of boys will find these courses of much value.

The best experience of the Y.M.C.A. in character-building activities among boys is made available. Two reference books are provided, each containing a scientifically prepared program arranged according to the age interests of boys, and covering their mental, social, physical and religious activities.

Topics Covered in These Courses:

PIONEERS (LT-3)— **COMRADES** (LT-2)—A study of the development of the program, its methods and purpose. Interviewing and charting a boy. Intellectual, physical, devotional, and service training. Charting a group. Arts, crafts and hobbies. Woodcraft and nature study. Athletics and aquatics. The find yourself idea. Self-analysis blank. Use of insignia. Ideals for a leader, all heading up in Christian citizenship.

Bible Teacher Training

(LT-6x)

The teacher desiring knowledge of the principles of biblical instruction will find this course valuable. It is not a Bible study course, but is designed to show how to teach the scriptures most effectively, and through this means build Christian character.

Topics Covered in This Course:

BIBLE TEACHER TRAINING (LT-4)—Qualification and preparation. Connection of body, mind and spirit. Adaptation and method. Perception and apperception. Attention and interest. Memory and imagination. Feelings and habit. Art of questioning and illustrating. Teacher's mistakes. Spiritual nature. Jesus the ideal teacher.

Advantages of Home Study

NO long arguments are needed here to establish the merits of correspondence instruction for those men and women who are so situated that they wish to use spare hours for study, but cannot attend a local class giving the instruction they need. Many thousands of successful home-study students afford ample and eloquent proof of the practical results of the method. Some of these men advanced to better positions in the same work; others changed to a more profitable or to a more congenial field.

The home-study student is the entire class—studies all the text himself and does all the reciting. His Instructor reviews all his work thoroughly and directs all criticism and extra instruction to him.

Capitalize Your Spare Hours

Spare hours can be used whenever they come. The school comes to the student. The mails reach him wherever he may be, with little expense for postage. He does not miss any sessions of his class. He can proceed as rapidly as he pleases or as slowly as he must.

The home-study student has unlimited time in which to finish his course. If interruptions come, he can take up his work where he was obliged to drop it.

The writing out of problems cultivates exactness and impresses principles on the memory. The writing of letters also affords the student valuable training in expressing himself clearly and concisely.

Methods of Instruction

The instruction methods used in the United Y.M.C.A. Schools are designed to furnish the largest possible amount of personal assistance to the student.

The textbooks studied in these courses are the best available. They have been adopted only after careful consideration of the newest and most authoritative publications of standard publishing houses.

Good as these textbooks are, however, they are only a part of the instruction material, serving the same purpose they would in a resident school.

Lessons dealing with every phase of his course serve to give the student a broad and comprehensive knowledge of the subject. The vital portions of the lessons are developed in a thorough, practical manner. To make these courses the most complete on the subjects, problems dealing with actual details, as encountered in practice, must be solved by the student and returned for correction. Errors are pointed out, and explanations of difficult points are given.

The student is not obliged to conform to our convenience. We furnish instruction to suit his needs and progress, and supply him with all necessary information.

Our one object is to give the student a thorough knowledge of the subject that will help him to accomplish whatever he has set out to do.

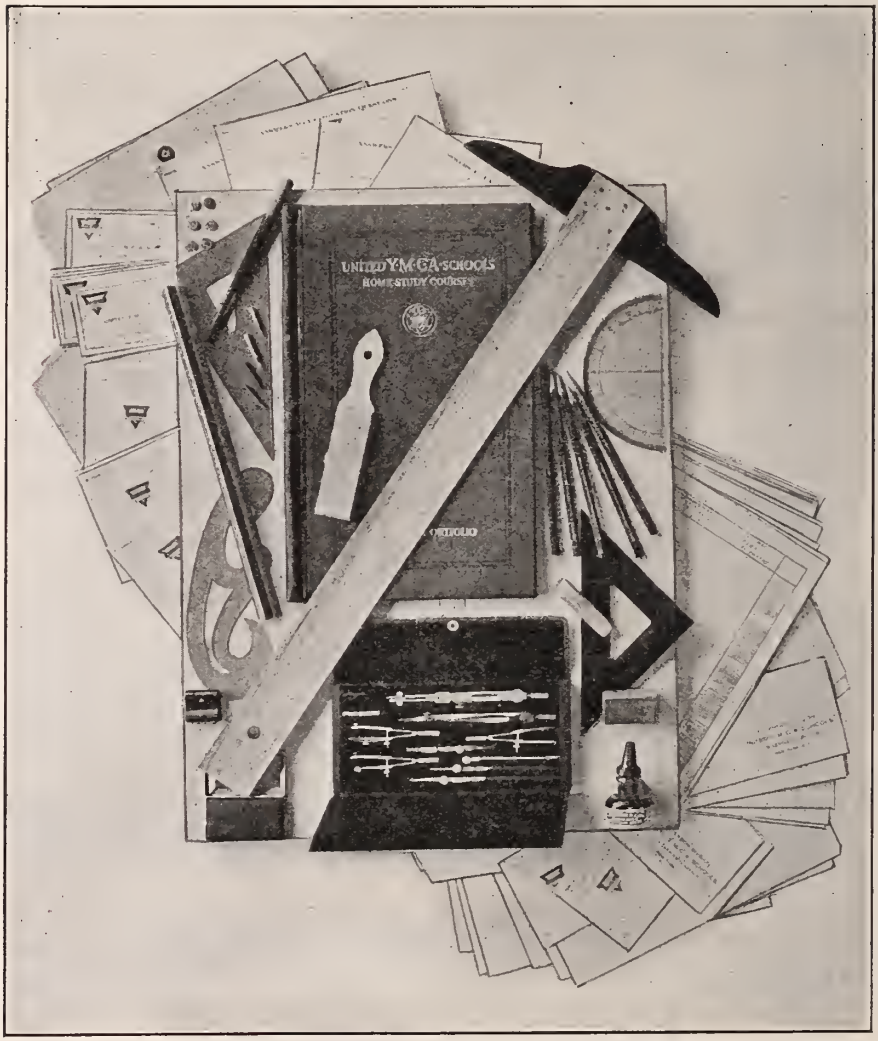
As soon as a student is enrolled for his course, he is supplied with several lessons, as well as the other materials necessary in order to proceed with his studies.

After his written examinations or drawing plates are received by us they are carefully corrected and returned to him, together with one or more new lessons. In this way he wastes no time, for he is always supplied with work.

Equipment Furnished

The low cost to the student of the "Y" correspondence courses is a well known fact, but it is not generally known that, regardless of the low cost, the student after he has enrolled for his course is supplied also with the best of working materials to assist him in getting all the practical benefit possible from his studies.

Not only do his modern and complete textbooks and lessons, that cover every phase of the subject studied, bring the student into close contact with the best minds in his chosen profession; but the theory gained from this study must be put into practice. So without additional expense he is furnished with a full set of supplies which may be called his working tools. This is a distinctive "Y" service that means a great saving to every student.



EQUIPMENT
Without Additional Expense.

Drawing Instruments and Supplies that accompany each of the Courses in which Drawing Instruments are required.

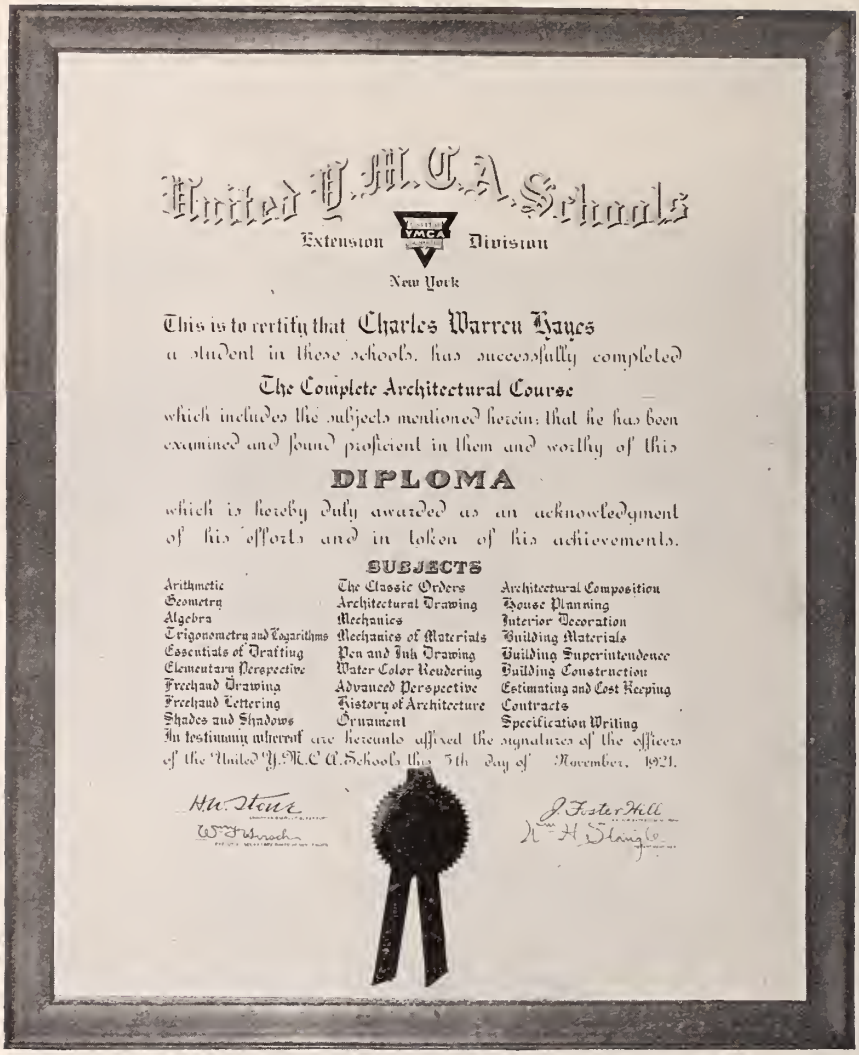
How to Enroll

ENROLLING for a home-study course with the Extension Division of the United Y.M.C.A. Schools is a simple matter. Just select your course carefully, after reviewing all of the information concerning the question, and fill out and mail an application, using either the form furnished by the Extension Division or writing a letter of your own. Enclose the payment in full, or in case you adopt the installment plan, the first payment.

Remittances should be made by bank draft, check, postal or express money order, or registered letter. Make checks and orders payable to Extension Division, United Y.M.C.A. Schools, 375 Lexington Avenue, New York, N.Y. We cannot accept responsibility for money sent in any other way, as it may become lost in the mails.

How to Begin Your Studies

Several lessons will be sent to you as soon as you are enrolled. Accompanying them will be standard or specially prepared texts and certain supplies, together with detailed instructions for your procedure, how to begin and how to continue your work. As you complete each lesson you forward it by mail to the Extension Division of the United Y.M.C.A. Schools. The lesson then will be carefully reviewed by your Instructor, who will grade it and write you about any points on which you seem to require special instruction.


United Y.M.C.A. Schools

Extension Division

New York

This is to certify that Charles Warren Hayes
a student in these schools, has successfully completed
The Complete Architectural Course
which includes the subjects mentioned herein; that he has been examined and found proficient in them and worthy of this

DIPLOMA

which is hereby duly awarded as an acknowledgment of his efforts and in token of his achievements.

SUBJECTS

Arithmetic	The Classic Orders	Architectural Composition
Geometry	Architectural Drawing	House Planning
Algebra	Mechanics	Interior Decoration
Trigonometry and Logarithms	Mechanics of Materials	Building Materials
Essentials of Drafting	Pen and Ink Drawing	Building Superintendence
Elementary Perspective	Water Color Rendering	Building Construction
Freehand Drawing	Advanced Perspective	Estimating and Cost Keeping
Freehand Lettering	History of Architecture	Contracts
Shades and Shadows	Ornament	Specification Writing

In testimony whereof are hereunto affixed the signatures of the officers of the United Y.M.C.A. Schools this 5th day of November, 1921.

H. W. Stone — J. Foster Hill

W. F. Ushachan — K. H. Slaught

Diploma

When the student has finished his study of each subject in a course, he is given a Subject Certificate. Upon satisfactory completion of the entire course, he is awarded a handsome engraved Diploma or Certificate bearing the official gold seal of the International Committee of the Y.M.C.A., and the Y.M.C.A. emblem in colors.

In the business and social worlds a Diploma or Certificate from the United Y.M.C.A. Schools is an excellent recommendation. It is not only evidence of what the student knows, but it is clear proof that he is a man of ambition and persistence, thinking of the future and that coveted goal—Success.

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